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Editorial

This issue contains seven papers with the various topics. The first one deals with the water quality in the lake Bohinjsko jezero. The researchers concluded that inflow of the nutriens has been increasing. The consequence is the serious faecal bacteria contamination of the lake. The main sources of the contamination, as they reported, are septic tanks in the neighbor houses and other dwellings, and a smaller part originates from pastures, meadows and fields. The implementation of the sewage system with the waste water treatment plant is to be in the first priority of the municipality responsible for the lake.

Quality of the process water in food processing is one of the most important factors of the food safety. Therefore the process engineers, food and technical experts can find the interesting paper containing the review of the process water treatment technologies used in food industry. From the water need to be removed pollutants such as organic matters, colour, odour and taste, dissolved gasses solids, and micro organisms. Every tape of the pollutants needs special treatment technology in order to achieve appropriate water quality.

The experts also found out that the wood is still more appropriate material in food production as plastics. In case of the egg pasta production has been showed that wooden frames are more resistant against micro organisms as plastic ones.

Two short reports are added to this issue. One is report of the AWARD project in the framework of the *EU Lifelong Learning Programme* and the second one contains the description and deals with the effectiveness of the Rapid Alert System for Food and Feed (RASFF) which was established by the EU Commission according the several EU Directives for the food and feed safety assurance on the EU market.

Our team and authors hope that readers will find interesting and useful information and research results needed in their own research, development endeavor and at the everyday work. We also encourage researchers and experts to contribute your valuable results and experiences to be published in the journal in order to share or even to upgrade your knowledge and know-how.

At the end, the editorial board wishes you MARRY CHRISTMASS and HAPPY NEW YEAR 2010 and of course many original research papers published as the result of your research and professional work.

Sincerely,

Janez Petek
Editor-in-Chief

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Content

Original scientific paper

Sources of the coliform bacteria in the lake Bohinjsko jezero

Martina **ODER**[1*], Anton **BRANCELJ**[2]

ABSTRACT

The lake Bohinjsko jezero is the largest natural lake in Slovenia. It is 4.350 m long, 1.250 m wide and 45 m deep. Nevertheless, biological and chemical indicators show that the inflow of nutrients has been increasing in recent years as a result of tourism. Furthermore, the presence in the lake of coliform bacteria of faecal origin has been detected. In 2006, several locations along the lake shore were controlled to investigate the faecal bacterial contamination of the lake. In 2007, the research was expanded from the lake itself to the affluent of the lake, the Savica river and adjacent high-mountain lakes. The evaluation of coliform bacteria used "the most probable number" (MPN) method. The number of bacteria in water samples varied from 0 to more than 438 per 100-mL sample. The results support the conclusion that part of the faecal coliform bacterial population originates from septic tanks in houses and other dwellings, and a smaller part from pastures, meadows and fields in the lake area.

KEY WORDS:

Coliform bacteria, Water pollution, Sources of pollution, Faecal pollution.

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INTRODUCTION

Each river, brook or lake can accept only a limited amount of substances in waste waters without evident consequences. The self-purification mechanism of natural water is accomplished through physical, chemical and biological processes [1]. Coliform bacteria are excreted with faeces, from which they enter to waste waters and then proceed, through unsuitably organized sewage systems, to natural waters. Faecal bacteria can therefore be an indicator that a water body is polluted with sewage from households, which usually contain waste water from toilets and bathrooms.

The presence of pathogenic bacteria in surface water bodies can represent a serious threat to human health because it can cause illness to those who have been in contact with this water. Some people may become ill even if there are a small number of pathogens in the water. Microorganisms, including bacteria, are typical found in colonies or small groups. A lower number of pathogenic units decrease the danger of infection, but on the other hand, a colony of bacteria represents a bigger threat than a solitary cell if it passes into the body. A human may become infected by the consumption of contaminated water, or by contact during water sports using natural water [2].

The presence of pathogenic bacteria in surface water bodies can represent a serious threat to human health.

E. Djuikom and co-workers assessed the microbiological water quality of the Mfoundi River with establishing the concentration of the total coliform, faecal coliform, and faecal streptococci. They conducted sampling with the goal of examining the potential origin of faecal contamination and the effect of rainfall on the measured concentrations of indicators organisms. They found high concentrations of total coliform, fecal streptococci, which varied according to the sampling sites and points. The ratio between faecal coliform and faecal streptoccoci shown that waters were contaminated more from warm-blooded animals than humans and according to the correlation analysis the rainfall is a contributing factor, which enhanced the bacterial numbers detected. The authors concluded that water from the Mfoundi River and its tributaries present a great potential risk of the infection for its users [3].

Extensive research has been conducted in many different lakes, seas and rivers that examined the presence, dynamics, distribution and survival of coliform bacteria of the faecal sources [4-7]. Some of these authors reported that the number of bacteria of faecal source increases after a heavy rain [5]. Researchers observed an increase in the number of the faecal coliforms in the Mississippi River after a heavy rain and then recorded a decrease of the bacterial population [6]. Research on Lake Ontario in North America revealed that the excrements of birds are an important source of faecal pollution [8]. A study in China of the activity of the coliform bacteria of the faecal sources revealed their presence not only in the water column, but also in the top layers of the sediments of the three lakes [7].

The lake Bohinjsko jezero is among those water bodies in which problems may occur concerning the presence of the pathogenic coliform

The aim of this study is to confirm the presence of the faecal coliform bacteria in Lake Bohinj and determine the potential sources of contamination.

bacteria. In theory, three ways can be expected how the bacteria may enter the lake: superficial run-off from nearby land, leaking of the cess-pits of summer houses around the lake, and underground transport through the karstic system from mountain lodges. For natural baths, the Slovenian Ministry of the Environment and Spatial Planning regularly prepares annual reports for execution of the monitoring of bathing waters [9]. This program is only executed in locations that are designated as official places for swimming. Other locations along the shores of rivers or lakes are not controlled [10].

The aim of this study is to confirm the presence of the faecal coliform bacteria in Lake Bohinj and determine the potential sources of contamination. The hypothesis is that the main source of pollution is tourism (hotels, alpine cottages, individual holiday houses), and to a less extent agriculture (pastures next to the lake, manuring meadows and fields).

METHODS

Sampling locations

Sampling locations were separated into three groups (Figure 1):

a) The lake Bohinjsko jezero

Seven permanent sampling locations were designated in advance along the lake, which were positioned equidistant and irrespective of tributaries and potential sources of pollution. During June-August, sampling points 1-3 were intensively occupied by swimmers. At the sampling

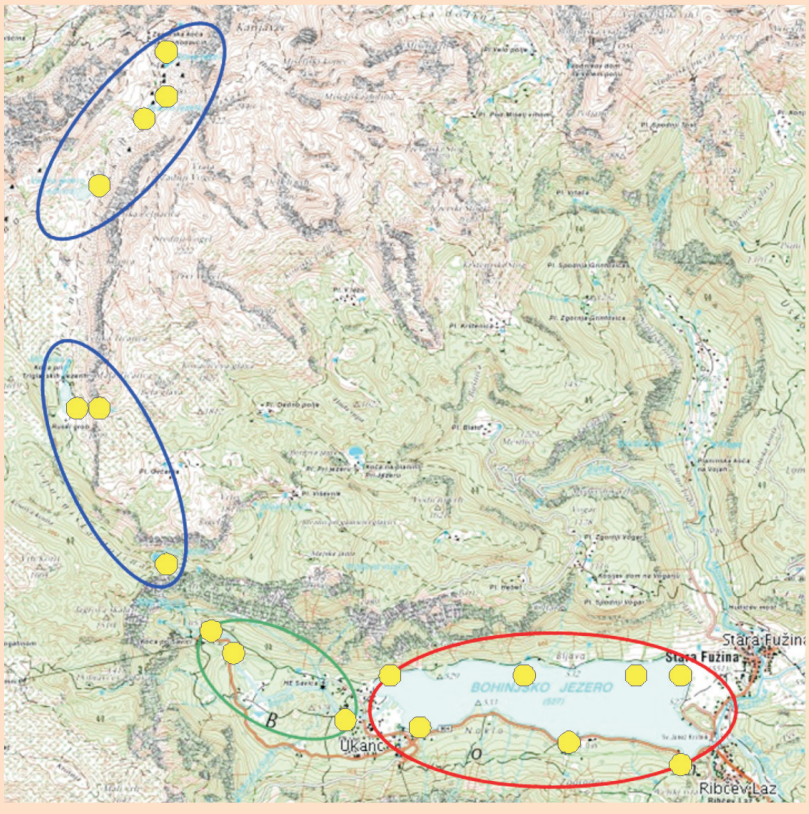

Figure 1:
The lake Bohinjsko Jezero with surroundings [12].

Legend:
- The lake Bohinjsko jezero
- The Savica river
- The Valley of Seven lakes
- Sampling point

point 4, there are many boats for most of the year and numerous tourists during the bathing season. There are also several summer houses in the neighborhood. Sampling points 5 and 6 were the least occupied by the swimmers. The sampling point 7 is officially registered as an area with natural baths [10].

b) The Savica river

Three sampling points were selected on the Savica river. Sampling point 1 was right below the waterfall, and sampling point 2 was located approximately 500 m downward from the waterfall, just behind the cottage Koča pri Savici and its cesspit that had never been officially emptied (according to the householder). Sampling point 3 was right before the outflow of the Savica river into the lake Bohinjsko jezero.

c) The high-mountain lakes

Sampling places on the high-mountain lakes were assigned for each lake separately. They are located in the Valley of Seven Triglav lakes, which is approximately 8 kilometers long. The lakes are referred to as the alp lake No. 1–7, starting from the most distal lake. There is no connection between the lakes in regard to water flow (either surface or subsurface). Water from all the lakes is collected deep in the masiff in a common channel, which opens as a spring of the Savica river. The highest lake (Rjavo jezero) is situated at an elevation of 2.002 m a.s.l. and the lowest lake (Črno jezero) is located at 1.319 m a.s.l. [11]. Right next to the lake Dvojno jezero (lake numbers 5 and 6) stands a mountain lodge (1.685 m a.s.l.), which is open only during the summer season when several thousands of visitors pass by or stay overnight.

Sampling procedure

Regular sampling in the lake Bohinjsko jezero was carried out throughout the bathing season (from June to September) in 2005, 2006 and 2007, and in the late autumn and the early spring, immediately after ice break. Occasionally, usually after rain, samples were also taken from some permanent tributaries and just below the Savica waterfall. The bathing season for continental from surface waters in Slovenia lasts from June 15 to August 31 [13]. Water was sampled in the distal alp lakes (No. 1–4) five times (in May, in June, twice in July, in September), while the remaining alp lakes (No. 5–7) were sampled seven times (May to October) in 2007. Details of air and water temperature, pH, visible pollution and weather were recorded for each sampling location. Water samples for microbiological analysis were collected in sterile bottles (volume of 300 mL) 1 m from the shore and 15 cm – 30 cm below the surface, following the protocol outlined in the Rules on the quality of bathing water [14]. Plastic gloves designed for single use were used during sampling. Samples were transported to the laboratory in a cooling bag at the temperature of +5 °C. Samples were delivered to the laboratory at least six hours after they were collected.

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The MPN method is recommended by the National decree for bathing water areas and the monitoring of bathing water quality.

Sample preparation and analyses

The lake water was analyzed with test-tube fermentation, which is used to determine the total number of the coliform bacteria and the number of the faecal coliform bacteria using the MPN method. Nine test tubes were prepared for each sample. The agar to determine the common coliform bacteria, prepared by LAP prescription, and a prescription by Mac Conkey for the faecal coliform bacteria was used. After incubation, the tubes were scored as +/- for growth on the basis of such factors as turbidity, gas production and appearance or disappearance of a substrate. Scoring a tube positive for growth indicated that at least one culturable organism was present in the dilution used for its inoculation. The number of positive and negative tubes at each dilution was used to calculate the number present in the original sample through the use of published statistical MPN tables or computer programs designed to simplify the analysis.

The MPN technique is very labor intensive and results are usually less precise than those obtained with direct plating methods [15].

However, the MPN method is recommended by the National decree for bathing water areas and the monitoring of bathing water quality. The value resulting from the MPN method was determined from the combination of positive and negative results obtained from a series of fermentation tubes used in a particular laboratory test [14]. The number of positive and negative tubes at each dilution was used to calculate the number present in the original sample through the use of published statistical MPN tables or computer programs designed to simplify the analysis. The MPN technique could be replaced by direct plating methods [15].

Calculation of the number of bacteria in a 100-mL sample was calculated by the equation 1 [16]:

$$C_{MPN} = \frac{n_{pt} \cdot 100}{\sqrt{V_{snt} \cdot V_{sat}}} \qquad (1)$$

C_{MPN} Number of bacteria in a 100 mL sample (mL^{-1}).
n_{pt} Number of positive tubes (1).
V_{snt} Volume of the samples in the negative tubes (mL).
V_{sat} Volume of samples in the all tubes (mL).

Data can be compared with maximum and recommended values as contained in the Supplement 2 of the Rules on the quality of bathing water [14]. Values in Table 1 are those that should not be exceeded in natural baths.

Table 1:
Hygiene demands for bathing waters in natural baths [14].

PARAMETER	RECOMMENDED VALUE	BOUNDARY VALUE
1. Total coliform bacteria (mL^{-1})	500	2.000
2. Faecal coliform bacteria (mL^{-1})	100	500

RESULTS AND DISCUSSION

The preliminary results of the assessment of the lake Bohinjsko jezero (in 2005 and 2006) shows the confirmation presence of the coliform bacteria of the faecal sources. In this 2-year period, 77 samples were taken from the lake Bohinjsko jezero and 15 from the main affluents. The number of bacteria in 100-mL samples from the lake Bohinjsko jezero varied from 0 to 438. On average, the lowest number of bacteria in 2005 was in April and in May, and in October in 2006. In regard to bacterial contamination, the most polluted places were number 1 and 7 [17].

Water analysis of the main affluent of the Savica river in 2006 showed that the faecal bacteria has already been present in the water under the waterfall, which indicates that some of the pollution comes from the high-mountain lakes.

The number of bacteria in 100-mL samples from the lake Bohinjsko jezero varied from 0 to 438.

The results of the analyses of water quality from 2007 are presented in Tables 2, 3 and 4. 49 samples were taken from the lake Bohinjsko jezero, 24 samples from the Savica river, and 41 samples from the high-mountain lakes.

Results for the analysis of water from the lake Bohinjsko Jezero showed (Table 2) that the coliform bacteria are present during all sampling periods (from May to October). Their numbers in a 100-mL sample were lowest in sampling places 5 (0–38 bacteria) and 6 (7–71 bacteria) on the north side of the lake. There are no contaminators or a constant affluent in this region. Other sampling places showed oscillations in the number of bacteria in water samples during the whole season. Sampling places 1 and 7 in the lake Bohinjsko jezero are the most contaminated (from 7 to more than 438 bacteria in a 100-mL sample) in areas with the highest number of swimmers.

The results for the sampling location of the Savica river 2 (Table 3), which is about 1 km from the waterfall indicates a higher number of the faecal bacteria (4–95 bacteria in a 100-mL sample) in comparison with sampling location 1 (0–46). The source of additional bacteria is Koča pri Savici and its septic tank, which is only 5 meters from Savica River. Results for the sampling location of the Savica 3 (near the inflow into the lake Bohinjsko jezero) indicated that faecal bacteria were found regularly, but not in May of 2007. The sources of bacteria for this location include summer houses and apartments in Ukanc, which are not all connected to the sewerage system. Located opposite these dwellings is a hotel, which is connected to the sewerage system.

The faecal coliform bacteria were present in three (No. 5–7) of the seven alpine lakes (Table 4). The number of the coliform bacteria in 100-mL samples from these three lakes varied from 0 to 76 bacteria. Common coliform bacteria were present (0–15 bacteria in a 100-mL sample) in the first four lakes, but it could not be confirmed the presence of the faecal coliform bacteria in these samples. The cottage near the lake Dvojno jezero (Alp lakes No. 5–6) does not have a waste-water treatment plant, and results of the analysis showed that the appearance

Table 2:
Number of the total coliform bacteria (bold) and the faecal coliform bacteria (in brackets) from the lake Bohinjsko jezero in 2007, (/) = not sampled.

Time of sampling / Place of sampling	21. May 2007	11. Jun. 2007	27. Jun. 2007	9. Jul. 2007	30. Jul. 2007	27. Aug. 2007	10. Sep. 2007	8. Oct. 2007
Lake Bohinj 1	**115** (95)	**190** (190)	**>438** (>438)	**>438** (>438)	**95** (58)	**271** (21)	**72** (15)	**14** (14)
Lake Bohinj 2	**271** (271)	**21** (7)	**58** (46)	**76** (46)	**95** (95)	**76** (7)	**20** (9)	**11** (11)
Lake Bohinj 3	**95** (0)	29 (0)	/ (/)	**>438** (139)	/ (/)	**29** (29)	**29** (4)	**19** (7)
Lake Bohinj 4	**4** (04)	**58** (20)	/ (/)	**46** (29)	**271** (21)	**438** (72)	**271** (20)	**190** (21)
Lake Bohinj 5	**15** (0)	**15** (9)	/ (/)	**38** (29)	/ (/)	**21** (15)	**29** (20)	**19** (11)
Lake Bohinj 6	**9** (6)	**190** (71)	/ (/)	**76** (46)	/ (/)	**29** (29)	**58** (20)	**19** (7)
Lake Bohinj 7	**190** (46)	**116** (95)	**>438** (438)	**190** (190)	**116** (116)	**271** (95)	**139** (58)	**58** (7)

Table 3:
Number of the total coliform bacteria (bold) and the faecal coliform bacteria (in brackets) from the affluent the Savica river in 2007.

Time of sampling / Place of sampling	21. May 2007	11. Jun. 2007	27. Jun. 2007	9. Jul. 2007	30. Jul. 2007	27. Aug. 2007	10. Sep. 2007	8. Oct. 2007
Stream Savica 1	**0** (0)	**0** (0)	**15** (7)	**95** (26)	**46** (46)	**46** (15)	**19** (11)	**20** (15)
Stream Savica 2	**9** (9)	**15** (7)	**9** (4)	**95** (95)	**95** (58)	**76** (21)	**15** (11)	**7** (7)
Stream Savica 3	**11** (0)	**21** (15)	**58** (58)	**29** (29)	**39** (29)	**76** (46)	**26** (15)	**20** (11)

Table 4:
Number of the total coliform bacteria (bolt) and number of the faecal coliform bacteria (bracket) in the sample of Lake Bohinj in the year 2007, (/) = not sampled.

Time of sampling / Place of sampling	21. May 2007	11. Jun. 2007	9. Jul. 2007	30. Jul. 2007	27. Aug. 2007	10. Sep. 2007	8. Oct. 2007
Alp Lake 7	**0** (0)	**0** (0)	**20** (7)	**29** (9)	**14** (14)	**46** (15)	**20** (14)
Alp Lake 6	**0** (0)	**4** (4)	**15** (9)	**76** (15)	**29** (20)	**19** (11)	**7** (7)
Alp Lake 5	**0** (0)	**0** (0)	**20** (14)	**31** (15)	**20** (11)	**20** (20)	**39** (4)
Alp Lake 4	**0** (0)	**0** (0)	**9** (0)	**15** (0)	/ (/)	**7** (0)	/ (/)
Alp Lake 3	**0** (0)	**4** (0)	**4** (0)	**9** (0)	/ (/)	**4** (0)	/ (/)
Alp Lake 2	**0** (0)	**10** (0)	**9** (0)	**7** (0)	/ (/)	**4** (0)	/ (/)
Alp Lake 1	**0** (0)	**0** (0)	**7** (0)	**4** (0)	/ (/)	**7** (0)	/ (/)

of the faecal bacteria in the water samples from alp lakes No. 5–7 is linked to the opening of the alpine cottage (samples in May and in June were negative). Water from toilets and kitchens is discharged into the surrounding environment only about 500 meters from the lake. The conclusion in that the faecal bacteria found in the Savica waterfall arrive from the mountain lodge by the lake Dvojno jezero because such a direct connection has already been established [18].

Water from toilets and kitchens is discharged into the surrounding environment only about 500 meters from the lake.

A comparison of Tables 1 with Table 2, 3 and 4 shows that values > 438 at the sampling places of the Lake Bohinj 1, 3 and 7 are close to the recommended level for the total coliform bacteria. If there is a need to obtain a more accurate number of the coliform bacteria, the accurate analysis should be used. Recommended values for the faecal coliform bacteria were exceeded three times in the sampling places of the Lake Bohinj 1 and 7, and once in the Lake Bohinj 2 and 3. None of the values in Table 1, Table 2 and Table 3 exceeded those for samples of the afflux Savica or the alp lakes either for the total coliform bacteria or the faecal coliform bacteria.

CONCLUSIONS

The lake Bohinjsko jezero is among the less polluted in Slovenia, but the results of a long-term monitoring program showed a slight trend towards increased pollution [19]. Water that enters the lake from the Alps is in the most cases clean and of good quality, but it is locally affected by the intensive alpine tourism. There are two main sources of pollution: contamination of high-mountain lakes as a result of the faecal water from alpine cottages, and contamination with water from toilets (and kitchens) that is properly treated.

The most of the faecal bacteria enter the lake through septic tanks within the lake's catchment area.

The results of this study show that most of the faecal bacteria enter the lake through septic tanks within the lake's catchment area. An additional small contribution comes from pastures, meadows and fields in the area neighbouring the lake. The hypothesis claimed that the main contaminators are stock-farming and agriculture, but it appears that in areas with a predominance of pastures and fields, lake contamination is low (sampling place Lake Bohinj 6). On the other hand, it was confirmed that some coliform bacteria are present in the lake Dvojno jezero (alp lakes 5 and 6), which drains into the lake Bohinjsko jezero. They were detected in a sample from the spring of the Savica river (the stream Savica 1), which connects directly with the aforementioned lake. Some increase in the concentration of the coliform bacteria was detected in the lower reach of the Savica river, indicating local pollution along the river itself.

The Bohinj community has a short-term and long-term plan for building a sewerage system connecting the whole region into the central cleaning mechanism.

The Bohinj community has a short-term and long-term plan for building a sewerage system connecting the whole region into the central cleaning mechanism. Due to technical problems, alpine cottages are not in that plan, and so it is necessary to find an *in situ* solution for the contamination problems imposed by these cottages. The reduction and control of pollution of the environment must be performed in all areas in which a human presence is either permanent or periodical.

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Professional paper

Water pre-treatment process in food industry

Marjana **SIMONIČ***

ABSTRACT

A successful food and beverage processing operation needs a stable high water quality supply and the appropriate treatment of wastewater. On many occasions the finished product is not just a result of the raw material, but caused by changes in feed water quality. Besides water quality, the most important requirement is reasonable cost for the feed water. There are several fresh water sources, which are chosen upon several factors. The most appropriate action is as less treatment as possible. The regulations are stringent and defined in detail. The objective of this review is to provide a brief explanation of the water pre-treatment methods available in food processing, emphasizing on clean technologies, such as membrane technologies, aeration and ion exchange.

KEY WORDS:

Drinking water, Food industry, Pre-treatment, Membrane.

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INTRODUCTION

Safe water and hygienic sanitation coverage is still low, especially in rural areas. Fresh water resources, especially those of high quality, are becoming scarce because of population growth and urbanisation [1]. The availability of good quality water and in high quantities is vital for food safety and production. Water can contaminate food: protozoa, viruses and in some cases even pathogens may be spread from contaminated water to the food. Such water is not potable and drinking or using such water in food preparation might lead to widespread acute and chronic illness.

The availability of good quality water and in high quantities is vital for food security and production.

Water influences the structure and taste of food and its receptiveness to spoilage. In any case, the presence of organic matter, colour, taste, and odour is unacceptable in water to be used in food and beverage processing operations, and must be removed.

Waste from food processing is similar to the food itself. More concentrated wastewaters come from processes where food is transformed in some way, such as the blanching the vegetables or pickling the meat [2]. The volume and contamination level of wastewater from food processing depends on the type of process and the size and age of the plant, as well as the season. Wastewaters are mainly high in organic matter. Biological oxygen demand (BOD) can be as high as 10,000 mg/L in wastewaters from breweries and distilleries. Wastewaters from farms are high in dissolved solids (up to 3,000 mg/L).

Water recycling within an industrial plant is normally integrated in to the industrial process. Food processing approaches based on good science will be needed in order to determine the synergic effects of hybrid technologies [3].

Food processing approaches based on good science will be needed in order to determine the synergic effects of hybrid technologies.

The use of recycled water will need the development of enzymes, the use of particle science, and other new technologies. Particularly good explanations regarding the microbial and chemical hazards of how new treating systems work will enable them to be applied in practice. Crucial public and professional acceptance is research on identifying appropriate indicators of microbial levels and determining human health risks. The most sustainable alternative has to be discussed, not only from the viewpoints of municipal companies, local authorities, local residents and environmental organization, but also, in each case, public opinion should be considered substantially.

PROCESS WATER

Process water is used in washing and sanitizing raw materials, process and ancillary equipment, and greenhouse. Water has to meet the safe drinking water standards. It has to be clear, colour-, taste- and odourless, or with other words free of contaminants affecting our sense organs.

The constraints of the beverage and food industries have to be fully understood and to be able to make suitable process water. The standards

and compliance with the quality specifications of the finished product must be ensured. Many enterprises provide innovative solutions for water supply requirements and their system has to ensure reliable supply of high-quality water and its control. Very important is also the system design, installation and maintenance.

PRE-TREATMENT PROCESSES

It is necessary to create water pre-treatment coupled with the principles of a single method, in order to enhance aesthetic acceptability, and the removal of toxic or health-hazard materials. Detailed description and advances are described in the following chapters.

We always believed that groundwater are reliable resource, but recent researches have proved that the water is contaminated by numerous organic chemicals, such as soluble organic substances (SOC), persistent chlorinated biphenyls (PCB), heavy metals, etc. Such contaminants are found along surface water supplies, and among them and in many rivers. These substances are mostly tasteless and odourless.

Water reuse within industry can be fully exploited, except for food and pharmaceutical applications.

Water reuse within industry can be fully exploited, except for food and pharmaceutical applications.

Often a variation in quality characteristics regarding a finished product is due to the quality of the water used in the process, and not a result of the raw materials or the process. Processors must know with certainty that the water supply meets the following requirements:

- Reliable–sufficient redundancy so a supply within an acceptable pressure range is assured regardless of drought or other adverse weather influences.
- Consistent quality.
- Consistently meeting of applicable water quality standards.
- Reasonable cost.

A quality public water supply should require little, if any, treatment prior to many of its uses. Public supplies are treated and tested to ensure they meet established safe drinking water standards for microbiological, inorganic chemicals, organic chemicals and radiological quality requirements.

Water should be tested regularly to assure compliance. Water used for cooking or added directly to the product must be potable and must be of sufficient quality not to degrade product quality. This includes being free of dissolved minerals that make water excessively hard or affect taste.

Public supplies are treated and tested to ensure they meet established safe drinking water standards for microbiological, inorganic chemicals, organic chemicals and radiological quality requirements.

Removal of organic matter

The most widely used systems are the conventional methods, such as precipitation, coagulation and flocculation, sedimentation and filtration. Dispersed, suspended, and colloidal particles producing turbidity and water colour, cannot be removed sufficiently by the normal sedimenta-

tion process. Adding a coagulant, mixing, and stirring the water cause the formation of settleable particles. These flocks are large enough to settle rapidly under the influence of gravity, and may be removed from suspension by filtration. In chemical precipitation units, coagulation and flocculation aids are usually added to facilitate the formation of large agglomerated particles. These are simpler to remove from the water. The precipitants, as well as other suspended solids, often have similar or neutral surface charges that repel one another. Coagulants, bounding to the particles in the wastewater stream, essentially convert the surface charges; as a result, opposite charges form between the particles, causing them to agglomerate. The use of inorganic metal salts (normally Al/Fe (III) salts) for coagulation is very well established in the field of water treatment. Flocculant aids, typically anionic polymers, are added to further enhance the agglomeration of the particles. The degree of clarification obtained depends on the quantity of the chemicals used, mixing times, and process control. One of the major disadvantages of coagulation is the handling and disposal of the sludge resulting from chemical precipitation.

Volatile organic compounds (VOC) are removed by aeration. The air diffuses into the water. The equilibrium between Φ_{VOC} in solution phase and c_{VOC} in the gas phase, is established according to Henry's law (Equation 1).

$$K_H = \Phi_{VOC}/c_{VOC} \quad (1)$$

K_H – Henry's Law Constant.

At constant temperature and pressure, the concentration of a substance in the vapour phase is proportional to its concentration in the aqueous phase.

Soap and detergent residues have to be carefully removed, in order not to produce scum and curd.

Organic contaminants are also removed by biological processes. Bacteria adapted to in-site specific conditions are able to degrade organic contaminants. As the contaminants are degraded, the adapted bacteria grow. The increased biomass is a waste that must be managed.

Colour, odour, and taste removal

When iron or manganese is present in water, both metals are oxidized (by dissolved oxygen) and, consequently, coloured precipitates are formed, not only in water but also on equipment, vessels, pipes and fixtures. A common treatment is ion exchange and the use of iron filters, mostly filled with catalytic materials, which are very efficient for iron and manganese removal, and require fewer chemicals for regeneration.

Adsorption on granular (GAC) and power activated carbon (PAC) is the most commonly used conventional methods and the most successful adsorbents used for organic matter as well as for colour, odour and taste removal. Activated carbon is prepared by activation at a high tem-

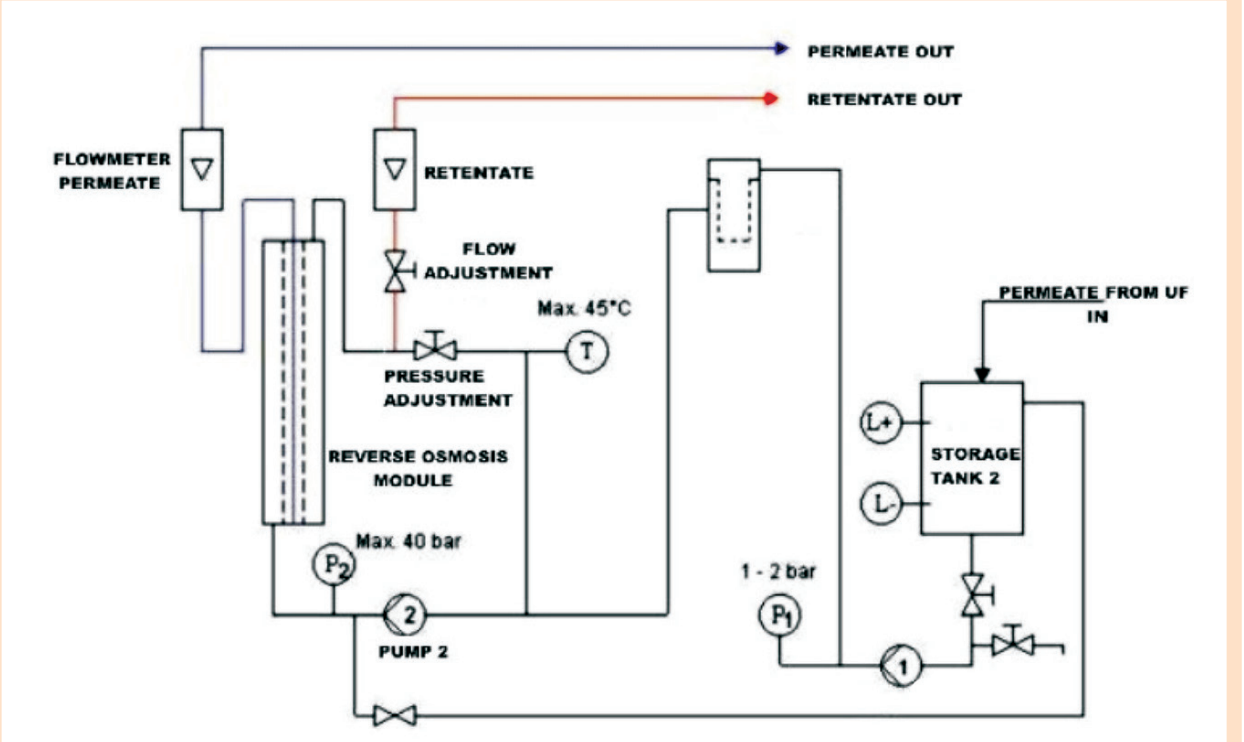
perature of 800 °C – 900 °C, from a variety of carbonaceous materials. Before carbonization, the raw material is pulverised, blended with a binder and palletised under pressure to give 5 mm – 10 mm spheres. After pirolysis at 500 °C, thermal activation follows in the presence of CO_2, which produces a complex of macro- and micro pores. A GAC surface area ranging from 750 m^2/g – 1500 m^2/g allows organic substances to be adsorbed from water. The adsorption depends on the nature of the adsorbent, surface area and pore structure, particle size, and surface chemistry. Increasing temperature decreases adsorption. Adsorption is a three step process:

- transport of the adsorbate from the solution to the outer surface of the adsorbent particle (diffusion controlled);
- transport from the outer surface to interior sites by diffusion within the macro- and micro-pores;
- adsorption at a site in the micro – pore – this is the most rapid step.

The overall rate is determined by the slowest step.

Reverse osmosis equipment can remove taste, colour and odour from water. It can remove all known micro-organisms and most other health contaminants. The reverse osmosis unit is shown in the Figure 1.

Figure 1:
Reverse osmosis unit
(Author: M. Simonič).



Membrane processes are characterised by the fact that the feed stream is divided into two streams: into the retentate or concentrate, and the permeate one. In all membrane processes separation is achieved by a membrane, which can be considered as a permselective barrier existing between two homogeneous phases. Transport through the membrane takes place when a driving force is applied to the components in the feed. In most membrane processes the driving force is a pressure difference or a concentration difference across the membrane. High pressure on the source side forces the water to reverse the natural osmotic process, with a semi permeable membrane permitting the passage of water while rejecting most of the other contaminants. This specific process is called ion exclusion, in which ions form a barrier for substances at a membrane's surface except for the water molecules. Hydrodynamic flux controlling factors are presented in the Figure 2.

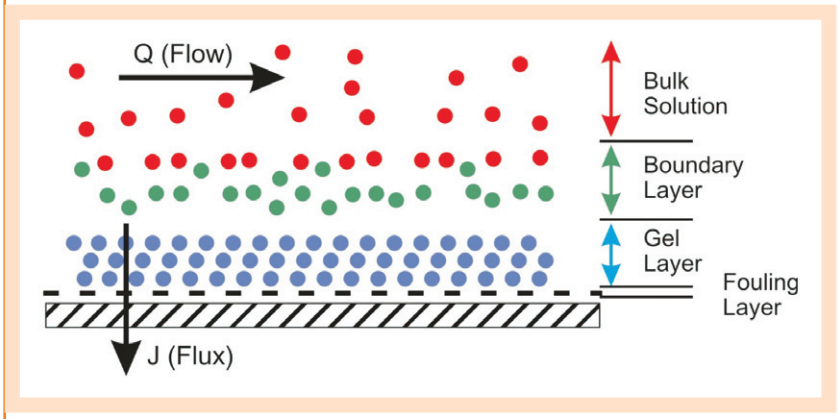


Figure 2:
Hydrodynamic Controlling Factors of Flux (Author: M. Simonič).

Degasification

Dissolved gases should be carefully controlled, as they can affect those products and processes in which the water is used. The removal of dissolved gases is accomplished by vacuum degasification column or aeration using another gas (nitrogen). Over the last few years membrane contactors have become commercially available. A membrane contactor utilises the same laws that govern the operation of conventional degasification columns.

Membrane contactors are shell and tube devices with micro-porous hydrophobic hollow fibres as presented on the Figure 3. Since water will not pass through the pores, the membrane's surface acts as an inert support that allows water to come into direct contact with the gas phase without dispersion. The partial pressure of the gas can be adjusted to control the amount of gas that will dissolve into water. Since the membrane contactor contains very small-diameter fibres, the interface between the gas and liquid phases becomes very high. This concept can reduce the size of a device. This newly patented design incorporates hollow fibre fabric array that is wound around a central distribution tube with a central resin baffle. Thus allows greater flow capacity.

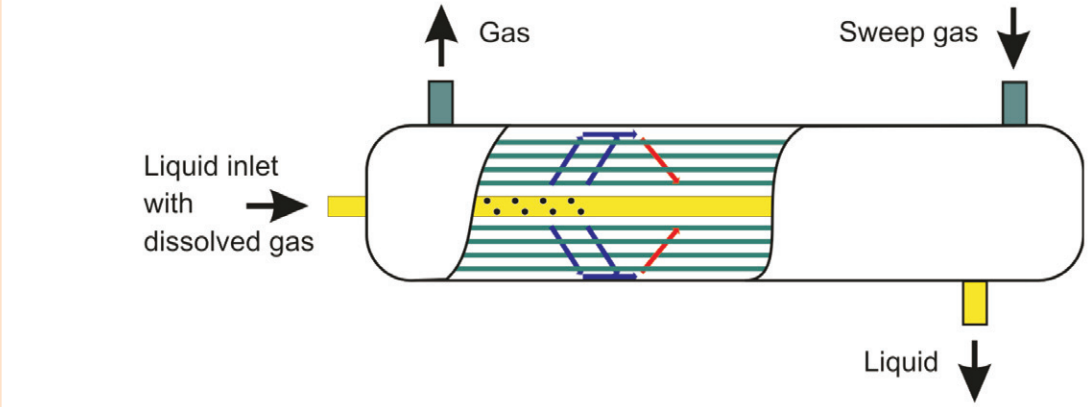


Figure 3:
The membrane contactor [5].

Water desalination

The selection of a water supply should be based on available quantity, quality, and cost of development, and investigating usable fresh surface water and groundwater thoroughly, prior to consideration of sources requiring desalination. When fresh water sources do not exist, saline water sources should be considered. The most commonly used parameter to differentiate between saline water qualities is total dissolved solids (TDS). Total dissolved solids are defined as the sum of the dissolved organic materials and the inorganic salts. Fresh waters contain less than 1,000 mg/L of total dissolved solids. Brackish water contains 1,000 mg/L – 20,000 mg/L of total dissolved solids. Sea water usually contains at least 20,000 mg/L of total dissolved solids. If well – water contains between 500 mg/L and 3000 mg/L of TDS and electricity is inexpensive, electro dialysis reversal or high – flux reverse osmosis is indicated. Without adequate pre-treatment, desalination facilities have reduced life-times, high maintenance cost and produced shorter periods of operation. Solids can be removed by a modern up-flow sand filter with a continuously cleaned filter bed, making shutdowns for backwashing of the filter bed unnecessary [4]. Also, reservoirs for wash water and sludge liquor can be spared.

The feed is introduced at the top of the filter and flows downward through an opening between the feed pipe and airlift housing. The feed is introduced into the bed through a series of feed radials which are open at the bottom. As the influent flows upward through the moving sand bed, the solids are removed. The filtrate exits at the top of the filter.

Simultaneously, the sand bed, along with the accumulated solids, is drawn downward into the airlift pipe, which is located in the centre of the filter. The sand and the solids are transported through the airlift into a washer/separator with a central reject compartment. As the sand falls through the washer, which consists of several concentric stages, a small amount of filtered water passes upward, washing away the dirt, while allowing the heavier, coarser sand to fall through to the bed. By setting

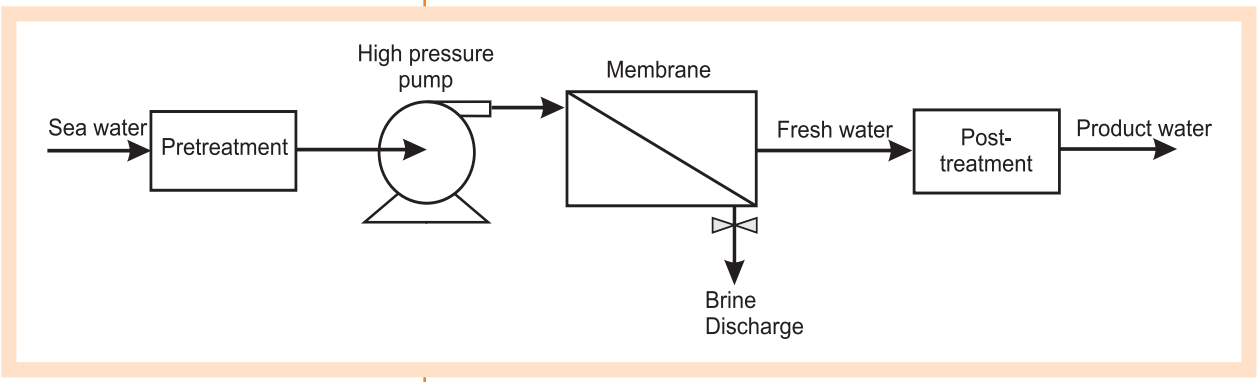


Figure 4:
Desalination process [6].

the reject weir at a lower level than the filtrate weir, a steady stream of wash water is assured. Continuous reject exits near the top of the filter. Optimal adjustment of the wash water volume is possible by varying the weir height.

The production of saline water usually requires a significantly larger quantity of saline feed than the quantity of potable water produced. After desalination of sea water more than 70 % of the intake may be rejected as brine, and only up to 30 % for product water, while by desalination of non sea or brackish water only 5 percent of the feed stream is rejected as brine [6].

Reverse osmosis has become the state of the art for water desalination (Figure 4). It is applied for the production of drinking and industrial process water from brackish water sources. Spirally wound elements are indispensable for power plants. Very high operating costs are still mostly connected to high energy consumption. However, the product water costs have dropped from 1 USD/m^3 in the early nineties to 0.55 USD/m^3 nowadays.

During membrane **desalination** operations at high recovery ratios, the solubility limits of gypsum and calcite exceed saturation levels, leading to crystallization on membrane's surfaces. The surface blockage of the scale results in permeate flux decline, reducing the efficiency of the process, and increasing operational costs.

In reverse osmosis elements, **colloidal pollution** can seriously diminish performance by decreasing productivity. An early sign of this pollutant is usually an increasing pressure gradient. The sources of this pollution in feed water can vary greatly. They are usually bacteria, clay, and iron corrosion products. Those chemical products used during pre-treatment may also cause fouling of the membranes. The best available technique for the determination of feed water fouling potential by colloids is the Modified Fouling Index (MFI) measurement. This is an important type of measurement that takes place prior to the design of a pre-treatment system. This measurement must be done regularly when the reverse osmosis (RO) system is put to use.

The number of micro-organisms in the surface water, in the feed water and in the concentrate can provide us with valuable information on the

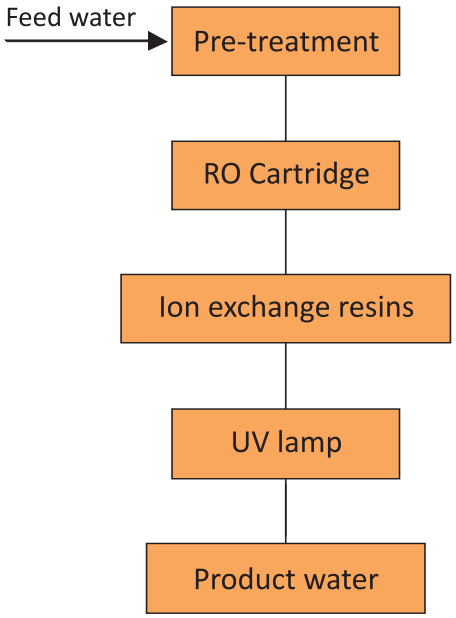


Figure 5:
The Milli-Q ultra pure water system [7].

degree of water contamination (bio-fouling). The types and concentration of nutrients present in the feed water are factors that determine bio film growth. Despite the fact that there are several investigators that determine the growth of bio films, it has not been fully researched yet.

Often the use of Millipore water is required, especially in the pharmaceutical industry. The principle is that, prior to RO membrane, some pre-treatment processes are needed, such as micro-filter and activated carbon filter for free chlorine and colloids removal from tap water (Figure 5). Ion exchange resins are continuously regenerated by means of an electrical current applied within the module itself. It provides the advantage of using resins of good quality all the time and needs no chemical regeneration that would deteriorate the resin beads. Two resins are placed between anion- and cation-permeable membranes, in a purifying channel each, and a concentrating channel is placed between them.

The anode electrode chamber is placed on one side of the first purifying channel, and the cathode electrode chamber on the other side of the second purifying channel.

Scaling

Hard water usually needs to be softened to be acceptable for food and beverage processing. Hard water causes toughening of vegetable skin during blanching and canning. Softening is mostly required to avoid scale. The tendency to develop scale ($CaCO_3$) during the treatment can be approximated by calculating either the Langelier Saturation Index (LSI) or Ryzner index (RI) [8,9].

The most common softening processes are precipitation, cation exchange, and demineralisation. Ion exchange resins are well suited for cation removal, because they have high capacities for cations, the resins are stable and readily regenerated, they are independent of temper-

ature and are very suitable for huge systems in the food industries. Most exchange material is manufactured by polymerisation of styrene and divinylbenzene. It has to be chemically activated to perform the ion exchange. Each active group has a fixed electrical charge, which is free to exchange with other ions of the same charge. The ion exchange material has to be insoluble, resistant to fracture, and of uniform dimensions. Strong acid cation resins are formed by treating the beads with a strong acid (H_2SO_4 or HCl).

Resin has a greater affinity to ions with higher valences – a predominance of high valence ions can cause a higher rate of reaction. Increasing temperature can speed up chemical reactions. The exchange reaction is a diffusion process, and the diffusion rate of the ion on the exchange site has some effect. The strength of the exchange site, whether it is strongly or weakly acidic or basic, affects the reaction rate, too. The selection of an appropriate resin for specific application is determined by feed water analyses, and the desired effluent quality.

Disinfection

The easiest way to destroy micro-organisms is to add 5 mg/L – 8 mg/L chlorine solution, lower concentration is used in a product to prevent off flavours. A less suitable method is pasteurization, especially because of processing costs (high fuel requirements). It is to boil water rigorously at 115 °C for 10 – 15 minutes. Very powerful disinfection is achieved by using ozone. It is prepared by electrical discharge in air or oxygen at high voltage. The half – life of ozone in water is 40 minutes at pH 7.6 and 14.6 °C.

Exposure to a sphere of water, 120 mm in diameter, to a point source of 254 nm radiation for 5 seconds is adequate for disinfection of bacteria and some other organisms. The radiation dose rate I_o (W/(m^2.s)) and the dose is $I_o \cdot t$ (W/m^2).

Groundwater contains only a few micro-organisms, while surface water contains a large number of many different kinds of micro-organisms. Microbial growth can be controlled by physical methods including the use of heat, low temperatures, desiccation, osmotic pressure, filtration, and radiation. Chemical agents include several groups of substances that destroy or limit microbiological growth. Factors affecting micro-organisms are temperature, pH, oxygen and water pollution. Human pathogens in water supplies usually come from contamination of water with faecal material. Many pathogens that leave the body through the faeces – many bacteria, viruses, and some protozoa can be present.

Water is usually tested for faecal contamination by isolating *Escherichia coli* from a water sample. *E. coli* is called an indicator organism because it is a natural inhabitant of the human digestive tract. Its presence indicates that the water is contaminated with faecal material.

Purification procedures for human drinking water are determined by the degree of purity of the water at its source. Water from deep wells or from reservoirs fed by clean mountain streams requires very little treatment to make it safe to drink. In contrast, water from rivers that contain

industrial and animal waste and even sewage from upstream towns, require extensive treatment before it is safe to drink. Some micro-organisms may remain unaffected by chlorine treatment. For example the Legionella species not only survive but multiplies in storage tanks and other water systems.

Worldwide, the most common bacterial diseases transmitted through water are caused by *Shigella*, *Salmonella*, enterotoxigenic *Esherichia coli*, *Campylobacter jejuni*, and *Vibrio cholere*. Viral infections include hepatitis A, Rotavirus and Norwalk-like virus. Common parasites include *Giardia lamblia*, *Cryptosporidium*, and *Entamoeba histolytica*. The first water-borne outbreak caused by cryptosporiridium occured in Texas in 1985.

A more serious problem is that several pathogens are more resistant to disinfection than coli forms.

A more serious problem is that several pathogens are more resistant to disinfection than coli forms. Chemically – disinfected water samples that are free from coli formed bacteria are often contaminated with enteric viruses. The cysts of *Giardia lamblia* and *Cryptosporidium* are so resistant to chlorination that eliminating them with this method is impractical. Mechanical methods, such as filtration and flocculation, are necessary to remove colloidal particles because the micro-organisms are mostly trapped by surface adsorption in the sand beds.

Routine examination of water and wastewater for pathogenic micro-organisms is not recommended, because very well-equipped laboratories with well-trained personnel are needed.

Final evolution must be based on examining a series of samples collected over a known and protracted period of time.

Examination of routine bacteriological samples cannot be regarded as providing complete or final information concerning sanitary conditions surrounding the source of any particular sample. The results of examination using a single sample from a given source must be considered inadequate. The final evolution must be based on examining a series of samples collected over a known and protracted period of time. The most effective microbiological monitoring of water source is to simply, rapidly, and inexpensively determine the presence of indicator bacteria: Coliform group, Faecal coliform bacteria, Heterotrophic plate count (HPC).

CONCLUSION

The described processes, recommendations for use and removal of contaminants are gathered in the Table 1. Whilst the economic benefits are the central point of management, more emphasize should be given to equally consider the environmental and social aspects in future decision-making processes. Long time ago some authors [10] pointed out that economic benefits are significant for companies which are looking for more effective solutions to pollution through conservation-oriented technologies by reducing water use and waste generation, because in food plants pollution prevention is more economical than pre-treatment.

Table 1:
Processes, recommendations for use and types of contaminants separated.

Process	Recommendation for use	Contaminants removal
Aeration	Degassing.	VOC, NH_3, CH_4, CO_2
Adsorption	Aromatics removal, colour, odour, and taste removal, dechlorination.	Phenols, BTEX, THM, aromatics, H_2S, pesticide
Cation/Anion exchange	Softening, denitrification	Calcium, magnesium, iron, manganesse, nitrate, arsenic
Chlorine/Chlor-dioxide	Disinfection	Bacteria, protozoa
Coagulation/ Sedimentation	Water purification	NOM
Membrane Contactor	Gas separation	CO_2, O_2, AOX
Membrane UF	RO pre-treatment, Disinfection	NOM, bacteria, protozoa
Membrane RO	Desalination	TDS, Hg, pesticide
UV	Disinfection	Bacteria, viruses

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Professional paper

Use the carbon footprint for the reduction of greenhouse gases – the case study of Port of Koper

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ABSTRACT

Carbon footprint is a calculating operation, which is used to calculate the volume of the produced greenhouse gases in CO_2 equivalents for a particular activity to be carried out on our planet. From the 18th century up to 2005, the amount of carbon dioxide (CO_2) in the atmosphere increased by 35 % (from 280 ppm to 380 ppm), showing a progressive upward trend in recent decades. The permissible annual emission of greenhouse gases (GHG), which nature can still neutralize, is around 2 tons of CO_2 equivalents per capita on the planet.

In Slovenia, the GHG emission is 10 tons of CO_2 per capita per year. Port of Koper implemented the port and logistics services and the trans-shipment in 2008 was 16.050.448 tons. Overall calculated level of emissions of CO_2 equivalents in 2008 was 43.009 tons. In 2008 the overall amount of GHG in the port, taking into account the simulated planed reduction measures, was about 32.000 tons of CO_2 equivalents or around 25 % less emission than in the current situation. Emissions would be much lower if the electricity in Slovenia was produced more eco-efficiently (up to 65 % lower emissions comparing to simulated reduction).

KEY WORDS:

Carbon footprint, Carbon dioxide, Greenhouse gases, Slovenia, Port.

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INTRODUCTION

Climate change has been identified as one of the greatest challenges facing nations, governments, business and citizens over future decades. Climate change has implication for both human and natural systems and could lead to significant changes in resource use, production and economic activities. In response, international, regional, national and local initiatives are being developed and implemented to limit greenhouse gas (GHG) concentrations in the Earth's atmosphere. Such GHG initiatives rely on the quantification, monitoring, reporting and verification of GHG emissions and/or removals. Port of Koper takes part of the *Climeport Project*, an environmental project funded by the European Union involving the main Mediterranean ports with the aim of palliating the effects of climate change. One of the principal aims of the project is to assess the importance of ports in this geographical area in the struggle against climate change by monitoring greenhouse gases from port activity. The project also promote the use of less polluting energy and the use of cleaner and more balanced transport, allow tools to be designed for measuring and monitoring the results obtained through the implementation of environmental improvement plans. The result of this project will also lead to the harmonization of CO_2 footprint evaluation of participating ports and to benchmarking and to the best practice identification in reducing GHG emissions. No data for ports GHG emissions is available at the moment.

A carbon footprint relates to the amount of greenhouse gases (GHGs) produced in our day-to-day lives through burning fossil fuels for electricity, heating and transportation etc.

Many organizations are seeking ways to understand, demonstrate and improve their environmental performance. This can be achieved by efficient managing those elements of their activities, products and services that can significantly impact the environment. Port of Koper has already implemented the environmental management system (ISO 14001) in year 2001 and yearly assesses its environmental performance against environmental policy, objectives, targets and other environmental performance criteria. In year 2008 port has decided to calculate and monitor one additional and new environmental indicator, the carbon footprint. A carbon footprint is a measure of the impact of activities that they have on the environment, and in particular climate change. It relates to the amount of greenhouse gases (GHGs) produced in our day-to-day lives through burning fossil fuels for electricity, heating and transportation etc. The carbon footprint is a calculating operation, which is used to calculate the volume of the produced greenhouse gases in CO_2 equivalents for a particular activity. GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydro-fluorocarbons (HFCs), per-fluorocarbons (PFCs) and sulfur hexafluoride (SF_6). The gases listed above have global warming potentials (GWPs) [6,7]. A GWP compares the radiation forcing of a tone of a greenhouse gas over a given time period (e.g., 100 years) to a tone of CO_2. In Table 2 are listed GHG with GWPs used in company [6,7].

From the 18th century up to 2005 the amount of carbon dioxide (CO_2) in the atmosphere increased by about 35 % (from 280 ppm to about 380 ppm), showing a progressive upward trend in recent decades [1].

The average temperature of our planet has consequently risen by about 0.7 °C from the 19th century to the present [2]. The permissible annual emission of GHGs, which nature can neutralize, is around 2 tons of CO_2 equivalents per capita on the planet [3]. In Slovenia, the GHG emission is 10 tons of CO_2 per capita per year and it is equal to the European average [3]. In the USA the emission of GHG is as much as 20 tons of CO_2 per capita per year, which makes them one of the top emitters.

Carbon footprint is an important element of assessment to identify the sources of emissions and to reduce them by considering and introducing appropriate measures such as the use of green energy sources and the reduction of fossil fuel consumption, appropriate waste management and recycling, which saves material costs and energy. Among other things, carbon footprint is used to compare the greenhouse gas emissions between companies, institutions, products etc.

Carbon footprint is used to compare the greenhouse gas emissions between companies, institutions, products etc.

The port of Koper offers port and logistics services. The basic activities cover cargo handling and warehousing services for all types of goods, complemented by a range of additional cargo services with the aim of providing customers with a comprehensive logistics support. Port of Koper operates eleven specialized terminals in an area of 2 720 000 m^2 and 25 ship berths are available at 3 200 m of operating coast. The trans-shipment volume in 2008 was 16 050 448 tons. The following reasons led to calculating the carbon footprint of the Port of Koper:

- to ensure sustainable development and environmental awareness of the company;
- to identify the major sources of GHG emissions;
- to facilitate the development and implementation of a GHG management strategies and plans;
- to facilitate the ability to track performance and progress in the reduction of GHG emissions and/or increase in GHG removals.

This paper presents the methodology for the carbon footprint evaluation of the Port of Koper and future actions towards the reducing of GHG emissions.

METHODS

In order to calculate carbon footprint, the directions from the following standards were used:

ISO 14064-1: 2006: Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals,

ISO 14064-2: 2006: Greenhouse gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.

For the calculation of the carbon footprint selected steps were performed:

Once the key categories have been identified, the data collection should follow. Data collection is an integral part of developing and updating a greenhouse gas inventory.

- establishing operational boundaries (that is identifying GHG emissions and removals, categorizing GHG emissions and removals into direct emissions, energy indirect emissions and other indirect emissions);
- quantification of GHG emissions and removals (that is identification of GHG sources and sinks – GHG inventory, selection of quantification methodology, collection of GHG activity data, selection or development of GHG emission or removal factors, calculation of GHG emissions and removals).

Compiling a greenhouse gas inventory is the step-by-step process. The first step for the GHG inventory was to identify the key categories for the inventory so that resources have been prioritized. For a new inventory a preliminary assessment based on local knowledge and expertise about large emission sources and inventories should be performed. Assessing the key categories helps to focus effort and resources on the sectors that contribute most to the overall inventory or inventory uncertainty and so it helps to ensure that the best possible inventory is compiled for the available resources. Once the key categories have been identified, the data collection should follow. Data collection is an integral part of developing and updating a greenhouse gas inventory. Data collection activities should focus on the collection of data needed to improve estimates of key categories which are the largest, have the greatest potential to change. Port of Koper collects ancillary data during operations for other purposes (i.e. fuel and electricity consumption, number of ships, vehicles entering the port etc.). Emissions and removals are estimated following the methodological choice and data collection.

The most common methodological approach for the calculation of GHG emissions is to combine information on the extent to which a human activity takes place (called *activity data* or t_{AD}) with coefficients which quantify the emissions or removals per unit activity. These are called *emission factors* (f_e) (Table 1) [5]. The basic equation is therefore:

$$q_e = q_{AD} \bullet f_e$$

m_e produced emission CO_2 in a year (kg/a)
t_{AD} human activities or consumption of the source of the GHG (kg/a)
f_e emission factor of CO_2 (kg/kg)

For example, in the energy sector fuel consumption would constitute activity data, and mass of carbon dioxide emitted per unit of fuel consumed would be an emission factor.

All the port GHG emissions presented in this paper were obtained using the calculation methodology mentioned above, no measurement was performed.

In order to make estimates of greenhouse gas emissions in carbon dioxide equivalents, it was necessary to examine the process of port activities and analyze in detail the equipment, machinery, frequency and the

time of entry and/or exit of the transshipment vehicles (ships, locomotives, trucks,...), heating/cooling techniques, power consumption, fossil fuel consumption, the amount of waste, business migration and all other sources of greenhouse gases.

In order to calculate carbon emissions, the following data were needed: the quantity of consumed fossil fuel, the quantity of consumed electricity, the quantity of waste disposal to landfill, water consumption from the water supply system, the amount of greenhouse gases from refrigeration systems and the leakage of fuel tank (vapor), etc.

In order to calculate carbon footprint, data from the different sources of GHG were multiplied by the appropriate emission factors [3,4] (Table 1) and thus quantified in tones of CO_2 equivalents.

Source of GHG	Emission factor for CO_2	Unit
Waste vessel oil	3.1500	kg/L
Vessel fuel	3.1500	kg/L
Diesel	2.6800	kg/L
Petrol	2.3100	kg/L
Liquefied petrol. gas	1.6800	kg/L
Waste landfill (estimated)	1.0000	kg/kg
Electricity in SLO	0.5500	kg/kWh
Waste water (calculated)	0.0002	(kg/kg

Table 1:
Emission factors for different source of GHG.

GAS	GWP (CO_2 in 100 years)
HCFC-22 R22	1.700
METHANE	21

Table 2:
Global warming potential for gases used in the company (ISO 14064-1/2: 2006).

The GWP is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kg of a trace substance relative to that of 1 kg of a reference gas. Substance's GPW is not the constant during the time. Particular substance concentration in atmosphere changes in time period as result of changing substance's chemical structure, e.g. methane has a potential of 72 over 20 years but 21 over 100 years. Commonly, a time horizon of 100 years is the most used.

The overall calculated quantity of CO_2 equivalents emissions in the company Port of Koper for the year 2008 was **43,009.62 tons.**

RESULTS AND DISCUSION

The current situation

The result of the GHG inventory and from the calculation of the GHG emissions in equivalents CO_2 revealed that the main source of CO_2 emission in port is because of:

- electricity consumption of machinery (i.e. electricity needed for the operation of cranes, lighting, shore side power supply, cooling, other);
- fuel consumption of merchant ships in port (i.e. operating of ships in the port);
- fuel consumption of port mechanization, port vehicles;
- fuel consumption due to towage of ships entering the port;
- incineration of ship waste oil;
- landfill of municipal port waste;
- fuel consumption from trucks entering the port.

Some other sources of GHG emissions are represented in Figure 1, but do represent a minor influence on the port carbon footprint.

Fossil fuel consumption is the main source of GHG – representing as many as 60.68 % of total emissions in the company. The fact that electricity in Slovenia is not adequately eco-efficient, is reflected in the emitted quantity of GHG, which is 13,321 t/a of carbon dioxide equivalents. It accounts for 31 % of total emissions in the company. The role of waste management has proven to be very important in the battle against greenhouse gas emissions, since despite the high level of recycling and re-use of waste, its contribution is 7.7 % of total emissions in the company. The consumption of potable water and leakage of gas from cooling systems are negligible sources of GHG. However, the gas in cooling systems makes a significantly higher percentage (5 %) in the case of discharge of the total quantity of refrigerant gas.

The overall calculated quantity of CO_2 equivalents emissions in the company Port of Koper for the year 2008 was **43,009.62 tons** (Figure 1).

Goals for GHG emission decreasing

In order to reduce CO_2 emissions in Port of Koper, the following long-term goals were set:

- the planned installation of photovoltaic power plant with an annual electricity production of 2000 MWh per year;
- the shift from fossil fuel to electricity for all port mechanization (electric service vehicles);
- promote and accommodate shore-side power;
- carbon footprint monitoring and management;
- reduction of the use of fossil fuels;
- further improve separate waste collection and recycling;
- further optimization of work processes in order to minimize energy consumption;

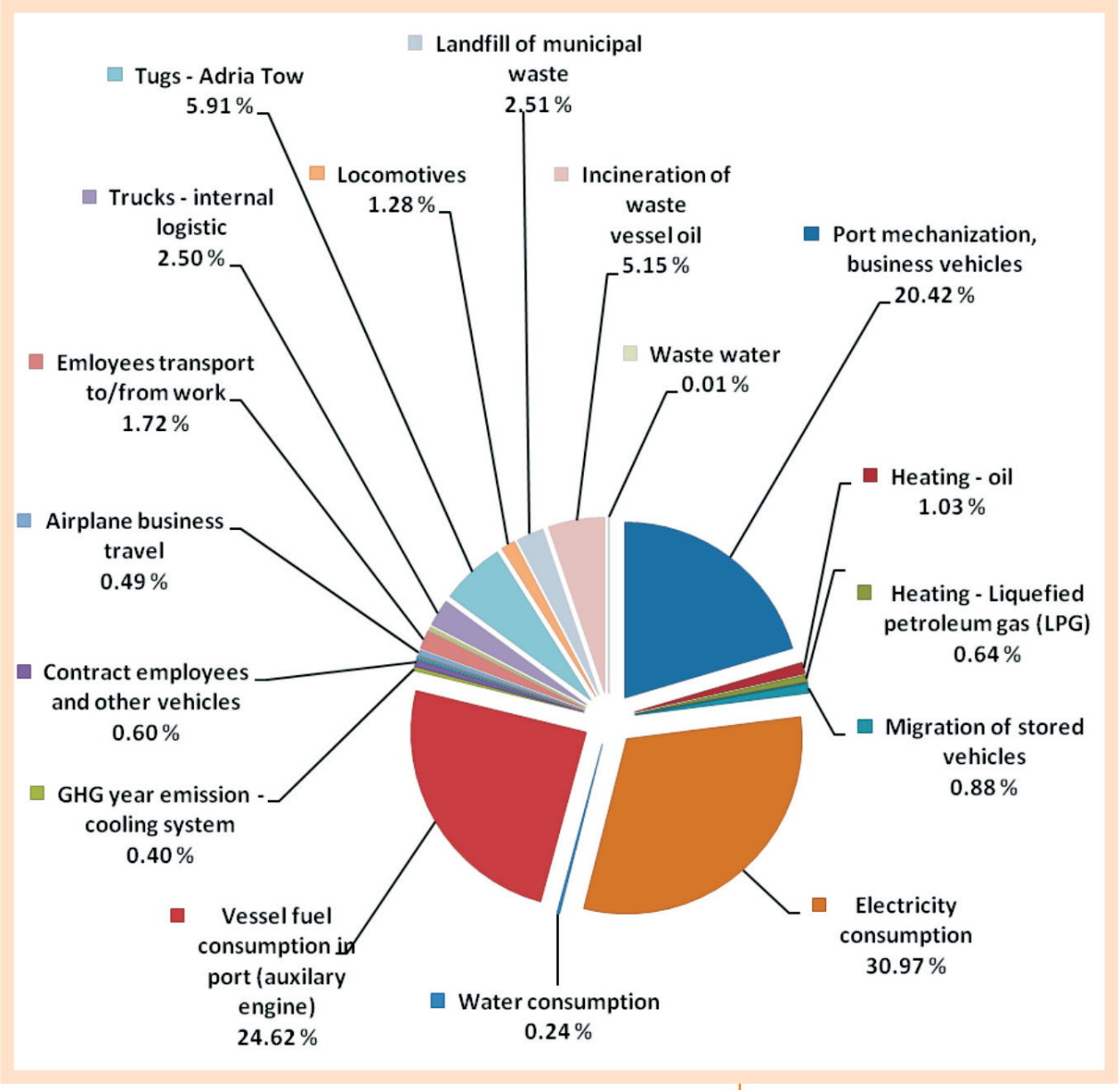

Figure 1:
Greenhouse gas emissions for particular segments of the company.

- replacement of greenhouse gases and ozone-depleting gases in cooling systems with the environment-friendly gases;
- increased environmental awareness of the population;
- lowering the energy consumption for lightening.

For the Port of Koper, the project of installing photovoltaic power stations with an annual electricity production of 2,000 MWh would result in emission reduction of 1,100 tons of CO_2 equivalents, or 2.3 % less emissions compared to the year 2008. The shift from fossil fuels to electricity to power the port machinery and service vehicles would result in the reduction of CO_2 emissions. Beside that it would also result in:

- reduction of noise;
- elimination of exhaust emissions due to winding up of the internal combustion engines;

Table 3:
Greenhouse gas emissions for all segments of the company.

SOURCE OF GREENHOUSE GASES		Emission CO_2 (t/a)	Portion (%)	Emission CO_2 (t/a)	Portion (%)	TOTAL Emission CO_2 (t/a)
ELECTRICITY CONSUMPTION	Electricity consumption	13,321.03	30.972	13,321.03	30.972	43,009.62
FOSSIL FUELS CONSUMPTION	Vessel fuel consumption in port (auxiliary engine)	10,587.82	24.617	26,098.28	60.680	
	Port mechanization, business vehicles fuel consumption	8,783.27	20.422			
	Tugs – fuel consumption	2,543.40	5.914			
	Internal logistic fuel consumption of trucks	1,075.14	2.500			
	Employees transport to/from work	739.50	1.719			
	Locomotives	552.30	1.284			
	Heating – oil	444.47	1.033			
	Migration of stored vehicles	380.16	0.884			
	Heating – Liquefied petroleum gas (LPG)	275.75	0.641			
	Contract employees and other vehicles	259.12	0.602			
	Airplane business travel	210.50	0.489			
	Mooring of ships	127.46	0.296			
	Ship pilotage	115.24	0.268			
	Fuel losses (vaporization)	2.57	0.006			
	Visitor tours – bus	1.58	0.004			
COOLING SYSTEM – GHG LOSSES	GHG year emission from cooling system	170.00	0.395	170.00	0.395	
WATER CONSUMPTION	Water consumption	102.20	0.238	102.20	0.238	
WASTE	Incineration of waste vessel oil	2,233.12	5.192	3,318.11	7.715	
	Landfill of municipal waste	1,080.00	2.511			
	Waste water	4.99	0.012			

- higher efficiency vehicles and consequently higher energy efficiency and reduction of emissions GHG (vehicles – fossil fuel about 20 % – electricity about 80 %);
- improved working environment.

The power supply for ships through the electrified piers would result in:

- elimination of noise from the operation of auxiliary vessel engines;
- elimination of direct GHG emissions and other exhaust gases and particulate matter in the port;
- increased energy efficiency and thereby reduced greenhouse gas emissions.

If taking into account the foreseen measures, the overall amount of GHG in the company Port of Koper in 2008 would be about 32.000 tons of CO_2 equivalents or around 25 % less emission than in the cur-

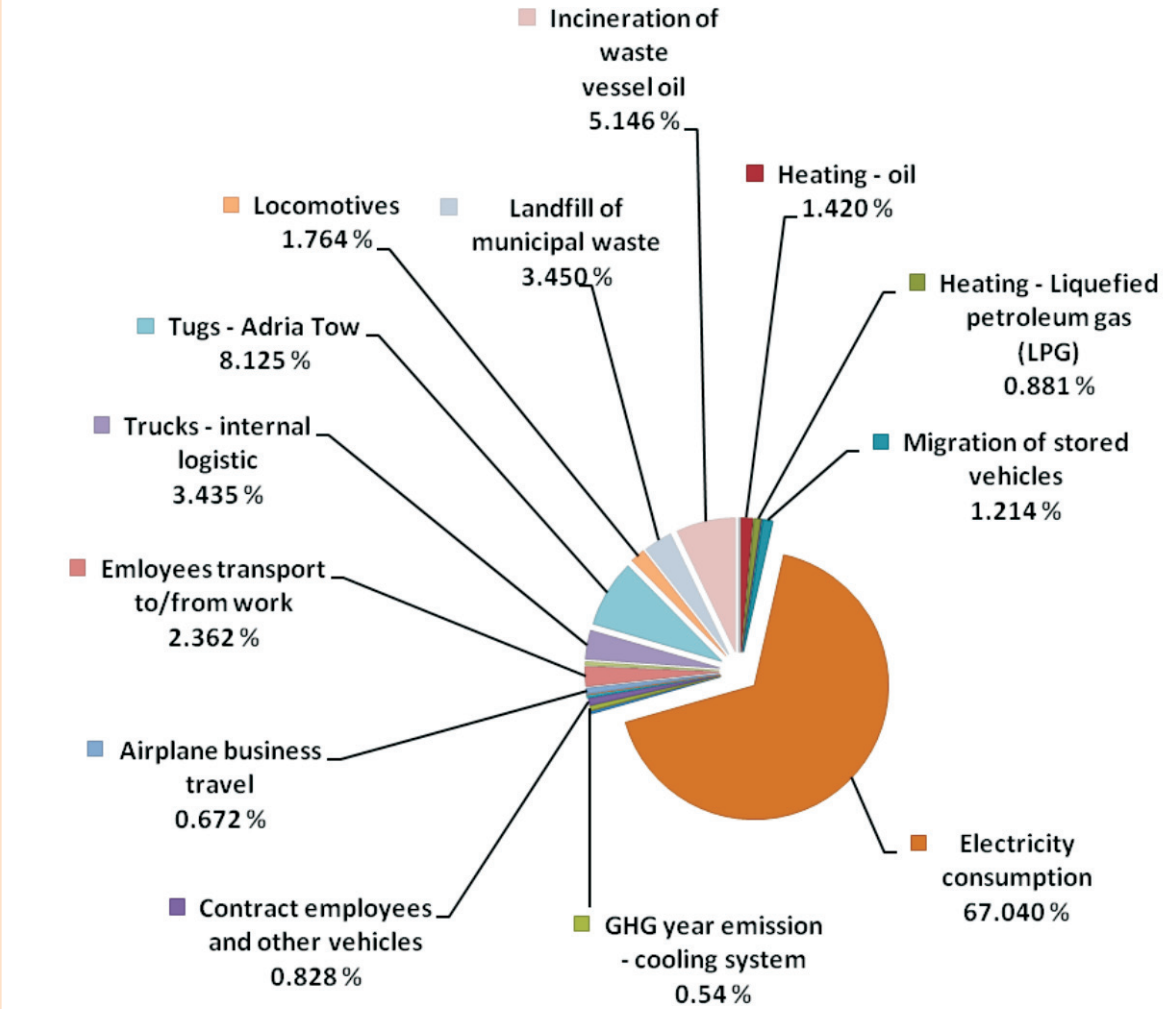

Figure 2:
Greenhouse gas emissions for individual segments in the company – a simulation.

rent situation. As we can see from the Figure 2, emissions would be much lower if the electricity in Slovenia was produced more ecologically (up to 65 % less or overall amount would be about 12.000 tones of GHG, if we were able to produce electricity based on zero emission technology).

CONCLUSIONS

Calculating the carbon footprint is only the beginning of the battle against the sources of greenhouse gases. Without taking the necessary measures to reduce emissions, this battle is worthless. Electricity production in Slovenia has the high emission factor due to the fact that one third of energy is produced by burning coal in thermal power plants (TE – Šoštanj, TE – Trbovlje, TE – Tol, etc.). In the future it is necessary to provide cleaner energy at the state level, primarily by reducing the use of fossil fuels, using renewable energy sources and new environmental technologies to generate power. By implementing these measures, greenhouse gas emissions could be reduced significantly, especially if it would be supplemented by the change in the technology of the transport.

The port of Koper demonstrates that the main reason for emissions of the greenhouse gases is the combustion of fossil fuels and electricity consumption.

The goal of Port of Koper is to develop balanced and harmonized actions in the whole group of participant Mediteran ports in the Climeport project in order to improve the weak points concerning greenhouse emissions of the ports. The carbon footprint has thus become a key environmental indicator which will be annually used as an environmental performance indicator. The carbon footprint for 2009 will show the effectiveness of implemented measures for climate change mitigation.

The port of Koper demonstrates that the main reason for emissions of the greenhouse gases is the combustion of fossil fuels and electricity consumption. Any activity is ultimately related to the use of fossil fuels and the production of GHG emissions. In the first stage the most efficient way of reducing the port carbon footprint is to use solar power. With this study we have now a better understanding of the port activities regarding GHGs emissions. This GHGs inventory has pointed out some problems that will be analyzed in the future in order to further optimization of the ports operations. The carbon footprint has also become an important indicator in choosing the best way of reducing GHGs emissions, in decision making. The reduction of GHGs has shown to be closely related to the usage of renewable energy and thus confirming port environmental strategy in using alternative energy sources. The future work will be also focused on checking the performance of different manufacturer/type of equipment, vehicles, crane, HVAC equipment, etc. using the carbon footprint as an indicator and thus making the GHG inventory even more detailed.

Future work on Climeport project will also give the opportunity to participating the Mediterranean ports to exchange best practice and to benchmark ports activities regarding energy efficiency and the GHGs emissions.

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Professional paper

Development of the Leonardo da Vinci Accessible World for all Respecting Differences – AWARD project

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ABSTRACT

In the framework of the EU Lifelong Learning Programme 2007-2013, *Leonardo da Vinci, Project Accessible World for All*, *Respecting the Differences* (AWARD) is currently underway. The aim of the project is to raise the awareness of need for accessible built environment, particularly in the population of vocational students who are faced with their professional advancements for the first time. The project is introducing relevant teaching materials into the curricula of the existing educational programs. The training involves all those vocations which are responsible for the built environment and health issues, from the design stage, execution of environment, to maintenance, supervision and use. The material is electronic and can be presented in the traditional form, as a distance learning tool or as individual learning material. The project group involves field experts of Universal design, vocational training and health issues from five EU countries. The preliminary testing of the material was performed at several schools in partner countries; in Slovenia the testing was done at the Departments of the Sanitary Engineering, Physiotherapy and Occupational Therapy at the Faculty of the Health Studies, University of Ljubljana. Results of feed-back evaluation will be included into the final version of the teaching material which will be available to the interested users by the October 2009. It is expected that as a consequence of better education, the result will be improved level of planning and execution of barrier free environment.

KEY WORDS:

Universal design, Life long distance learning, Barrier-free environment.

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The disability community is large – much larger than most people think. The definition of disability was put forward in December 2006 by the United Nations Convention on the Rights of Persons with Disabilities.

INTRODUCTION

Across Europe, human diversity in age, culture and ability is greater than ever. We now survive illnesses and injuries and live with disabilities as never before. Although today's world is a complex place, it is one of our own making, one in which we therefore have the possibility – and the responsibility – to base our designs on the principle of inclusion [1].

The disability community is large – much larger than most people think. The definition of disability was put forward in December 2006 by the United Nations Convention on the Rights of Persons with Disabilities. It means any physical or mental impairment that substantially limits one or more of the major life activities of an individual, a record of such impairment, or being regarded as having such an impairment [2]. It includes not just people in wheelchairs, but also people with other mobility problems related to diseases such as polio or rheumatism, people with low levels of vision, people with speech or hearing impairments, people with cognitive disabilities, people with heart disease and severely disabled people who may be confined to bed. Disability can also be temporary, for example sprained ankles, consequences of automobile accidents, or difficult pregnancies [3].

Social problems connected to barrier unfree environment and lack of ethnical approach arise from our youth ages. Knowledge and understanding of basic principles of Universal design should be introduced in early stage education, starting from school ages, and should be included in every educational process. This could be achieved by introducing relevant teaching materials in education programs. Steps in this direction have been made in the Resolution ResAP(2001)1 on the Introduction of the Principles of Universal design Into the Curricula of All Occupations Working on the Built Environment – Council of Europe, adopted by the Committee of Ministers on 15 February 2001, at the 2nd meeting of the Ministers Deputies. The main conclusion of Resolution ResAP(2001)1 was "to take a proactive approach by recommending the incorporation of the universal design principles into the curricula of architects, engineers and town planners, and, by and large, into the training of all vocations working on the built environment" [4]. Regrettably this recommendation has not been met yet. Many buildings can not be used by people with disabilities. Either their needs have simply been forgotten, or they have been misunderstood or have been knowingly disregarded by designers and/or constructors and decision makers [4].

Despite numerous existing guidelines and regulations, their final realization is still insufficient. Moreover, the importance of universal design by manufacturers or designers is not clear enough. They usually know how to design barrier-free environment for a disabled person, but not why or how it will be used. Field regulation in Slovenia is being put into effect step-by step. New buildings are designed according to regulation demands. More problematic is the existing building stock which in most cases does not conform to the principles of universal design. From everyday practice it can be noticed that the environment is usually adapted

mainly to wheelchair users, i.e. curb ramps, barrier-free public toilets can be found everywhere. But persons with visual, hearing or cognitive impairments are often forgotten (i.e. tactile markings, contrast markings, visual alarms are still very rare).

Because of serious lack of knowledge and awareness, adequate information should be included into the existing curricula as part of standard teaching process. Considering that the main idea of the project is the application of basic principles of universal design into everyday practice, designers and contractors have to know what to do, but also why and how the element will be used by a disabled person. This kind of approach was successfully used in the project *Vocational Education Training in Building Observation, Operation and Maintenance* (Pilot Project No. HU 170003 – 2003) [5], but the subject area of accessible design was touched only briefly.

In the framework of the Lifelong Learning Programme 2007-2013, Leonardo da Vinci the EU project *Accessible World for All, Respecting the Differences* (acronym AWARD) is running. The project AWARD started in September 2007 and ended in September 2009. It involves six partners from five EU countries: Budapest University of Technology and Economics from Hungary (BUTE), Motivacio Foundation for Helping Disabled People from Hungary (MFHDP), Dundalk Institute of Technology from Ireland (DIT), University of Trento from Italy (ULT), Technical University of Cluj – Napoca from Romania (TUCN) and University of Ljubljana, Faculty of Civil and Geodetic Engineering from Slovenia (UL FGG). In joint work it combines field experts of Universal design, vocational education techniques, health issues and functional disabilities [6].

In the framework of the Lifelong Learning Programme 2007-2013, Leonardo da Vinci the EU project *Accessible World for All, Respecting the Differences* (acronym AWARD) is running.

With respect to the above stated problems the project aims at creating teaching material in e-learning interactive form, attractive to young population. The target groups are vocational schools, high schools and other study programs, particularly those that are responsible for the built environment and health issues, from the design and execution stage to the maintenance and supervision. It will cover the complexities of vocations and will be applicable not only to traditional, but also to distance and individual learning [6]. The paper presents the application of teaching material at the Faculty for Health Sciences, University of Ljubljana, the results of their testing and the final results evaluation.

LEGAL BACKGROUND

There are approximately 650 million persons with disabilities in the world, or 10 per cent of the global population. An estimated 80 per cent of these persons live in developing countries, many in conditions of poverty [7]. Disabled people, older people and other persons with temporary reduced mobility together make up 40 % of the European population. Moreover, people live longer, greatly extending the period of aging that is one of the primary causes of disabling conditions. DeJong and Lifchez [8] report that 46 % of the population aged 65+ have either limited or severe disabilities According to studies by the Commis-

sion for Social Development carried out in 2008, 34.5 % of the European population will be aged 60+ in 2050 compared to 20.3 % in 2000 [7]. The demographic data of Europe as well as those in the countries of the consortium members show the 6 % to 8 % increasing ratio of elderly people in the forthcoming years. By this measure, it is likely that most people will have some disabling condition, if they live long enough [3].

Statistical data in Slovenia show that in 2007 26 % of the population was aged 60+ [9,10]. The number of persons granted invalidity (disability) status and appropriate social benefits during 2007 in Slovenia was 373.26 new invalidity/disability cases per 100000 [11]. In the Republic of Slovenia 39 different associations are registered to protect and enhance the rights and opportunities of disabled people. However, the Association of paraplegics in Slovenia, founded in 1982, has today 1009 members, with the average age 46 years [12]. The rights of the disabled to the independent life as well as the obligations of society are declared in several national documents and regulated by the Constitution of the Republic of Slovenia [13]. The Spatial Planning Act [14] presents guiding law in the field of spatial planning, regulated by the Ministry of Environment and Spatial Planning. It includes barrier free access to, entry to and use of building for people with functional dissabilities among basic goals of spatial planning (article 3). The Construction Act [15] defines in article 17 barrier free movement in new or reconstructed building. Concrete rules of the Universal design arranged with the Construction Act are: the Rules on the requirements for free access to, entry to and use of public buildings and facilities and multi-apartment buildings [16], the Rules on minimum technical conditions for the construction of apartment buildings and apartments [17], the Rules on minimum technical requirements for residential units intended for temporary solving of housing needs of socially deprived persons [18], the Rules on minimum technical requirements for the construction of residential care homes for elderly and on ensuring conditions for their operation [19]. The Guidelines about construction and needs of functionally disabled persons in the built environment are edited by the Slovenian national standard SIST ISO/TR 9527 [20]. Ministry of Labour, Family and Social Affairs regulates the Rules on minimum technical requirements for social services providers [21]. Article 92 of the Rules on requirements for ensuring safety and health of workers at workplaces [22] defines that employer has to arrange workplaces in such way that they take into account dissabilities and impairments of employees. The requirement especially refer to doors, passageways, stairs, bathrooms and lavatories used by the dissabled employees and to workplaces of the dissabled employees. Article 10 of the Placement of Children with Special Needs Act [23] prescribes preschool programs, educational programs with adapted curricula, additional specialist help, adapted programs, appropriate spaces and assistive technology for children with special needs. All directives for execution of adapted programs have to be adopted by a competent expert committee. The Ministry of Sport and Education defines Rules on norms and minimum

technical requirements for spaces and equipment of nursery schools [24].

On December 13, 2006, the United Nations formally agreed on the Convention on the Rights of Persons with Disabilities, the first human rights treaty of the 21st century, to protect and enhance the rights and opportunities of the world's estimated 650 million disabled people [2,7]. Nevertheless, the implementation of these rights is far from ideal, partly due to lack of ethical approach and empathy, partly due to lack of knowledge. This is reflected in inaccessible build environment that enables, disables or even injures not only people with disability but also healthy ones. To prevent that, built environments have to be created or modified by people so that people may live in and/or develop various activities. The environment should be modified that everybody can enjoy it. The designer, then, has a responsibility to consider the entire life span of the individual. Disability is a normal condition of life that should be taken into account in all that is designed and produced, including housing [3].

The goal of accessibility to the built environment was recognised internationally in 1993 in the United Nations Standard Rules on the Equalisation of Opportunities for Disabled Persons [19]. The universal design or design for all is design for human diversity, social inclusion and equality. This holistic and innovative approach constitutes a creative and ethical challenge for all planners, designers, entrepreneurs, administrators and political leaders. Design for all aims to enable all people to have equal opportunities to participate in every aspect of society. To achieve this, the built environment, everyday objects, services, culture and information – in short, everything that is designed and made by people to be used by people – must be accessible, convenient for everyone in society to use and responsive to evolving human diversity [25].

TEACHING MATERIAL STRUCTURE

Project work programme is divided into work packages covering various stages of the project (Table 1). In the first preparatory phase, the relevant materials and illustrations were collected and edited. This phase also included writing of screen-plans, recording of typical situations with disabled persons, illustrating the difficulties and demonstrating possible solutions. The second phase includes preparing of the basic material. It includes study of the national and international legislation, recommendations, standards and guidelines. All information from preparatory and second phase was formed into hypertexts and edited in the draft form of a DVD that presents the basic version of the electronic teaching material. The third phase presents translation of material into the languages of the participating countries. For every selected vocation extracts were done. All teaching material was adapted to national regulation, building practice and educational system. To provide technical, pedagogic and psychology advice for trainers, a teacher handbook was prepared and translated [6].

Table 1:
The project work programme.

Work package	Title	Aims
1	Meeting, seminar	Decision making, evaluation of interim deliverables, dissemination, management.
2	Screen plans	To write screen-plans of records, illustrating the problems and the solutions.
3	Collection of illustrations for photo-gallery	To illustrate good practices, regular solutions as well as typical examples of sloppiness.
4	Recording	To record DVDs illustrating the problems of people with different disabilities in different environments.
5	Edition of DVDs	Edition of DVDs.
6	Edition of the basic hypertext	To provide the basic version of the electronic teaching material.
7	Translation of basic teaching material	To have the teaching material in national languages of the member countries, adjusted to the national regulation, building practice and educational systems.
8	Extracts for selected vocations in English	Comprehensive teaching modules for selected vocations.
9	Translation and adaptation of comprehensive teaching material	To have comprehensive teaching material for selected vocations in national language, adapted to national regulation, building practice and educational system.
10	Teachers` handbook	To provide technical, pedagogic and psychology advice for trainers of traditional and distance learning.
11	Translation of teacher` handbook	To have the handbook in the national languages of the consortium member countries.
12	Test courses	To test the teaching material under real conditions.
13	Evaluation of feed-back	To evaluate the feed-back, to make necessary corrections if any.
14	Disseminations	To raise awareness, to disseminate the projects results, to facilitate the implementation of the concept and techniques of Universal design in many vocational schools, to change the attitude of professionals, decision makers and the society.
15	Management	To coordinate and run the project following the administrative and financial rules.

In the time of the paper writing the project was in the phase of the evaluation of feed-back and making corrections of the teaching material. The first version of teaching material was tested by selected trainers and students under real conditions. Project participants selected vocational schools and ran short intensive courses. All teaching material was first presented to trainers and then to students. Trainers included material in their lectures, seminars and practical work. Material was presented via traditional learning process and also put on the www for a distance learning process. After the courses questioners for trainers and students were given out. Results and suggestions were collected and are being evaluated.

Sanitary engineers were selected as target group because knowledge about the Universal design presents an important part of their future work.

In Slovenia the material was tested at the Faculty for Health Studies, University of Ljubljana, the Department for Sanitary Engineering, the Department of Physiotherapy and Department of Occupational Therapy. Sanitary engineers were selected as target group because knowledge about the Universal design presents an important part of their future work. They will be professionally involved in the process of design, advice and supervision of build environment. During their study program they learn about some aspects of the Universal design, but not all. The 1st year of Physiotherapy was selected because the students are involved in the process of healing and rehabilitation, but they are not yet

familiar with the aspects of the Universal design. The Occupational therapy was selected, because the students work with disabled persons, help them to perform everyday activities and within their work come across many problems that arise from inaccessible built environment [6].

The teaching material was uploaded on the school server, where students were able to use it as a study literature (Figure 1). The material was used in various courses, partly as lecture material and partly as distance learning material for practical work during spring semester of 2008/2009. After finished courses students were asked to evaluate the comprehensibility of modules, usefulness of modules and other experiences with the tool via questionnaire (Figure 2). The questionnaire was divided into two main parts. The first part of the questionnaire was used for qualitative analysis of data and second part for quantitative analysis. In the first part, students were asked to validate comprehensibility of modules with prepared validation scale: 1-not comprehensible, 2-quite compressible, 3-comprehensible, 4-very compressible, 9-not used module. Usefulness was validated with scale: 1-not useful, 2-quite useful, 3-useful, 4-very useful, 9-not used module. In the second part students were asked to write their proposals and reprimands. They

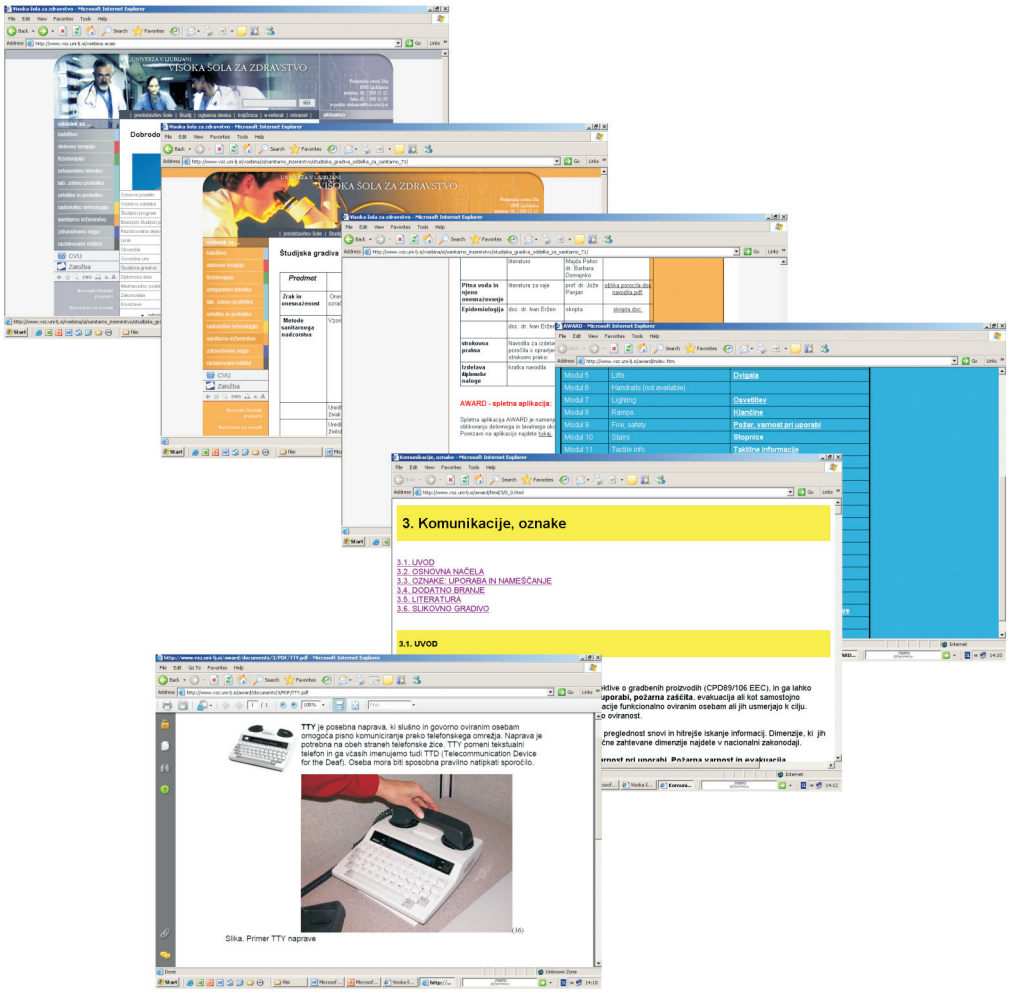
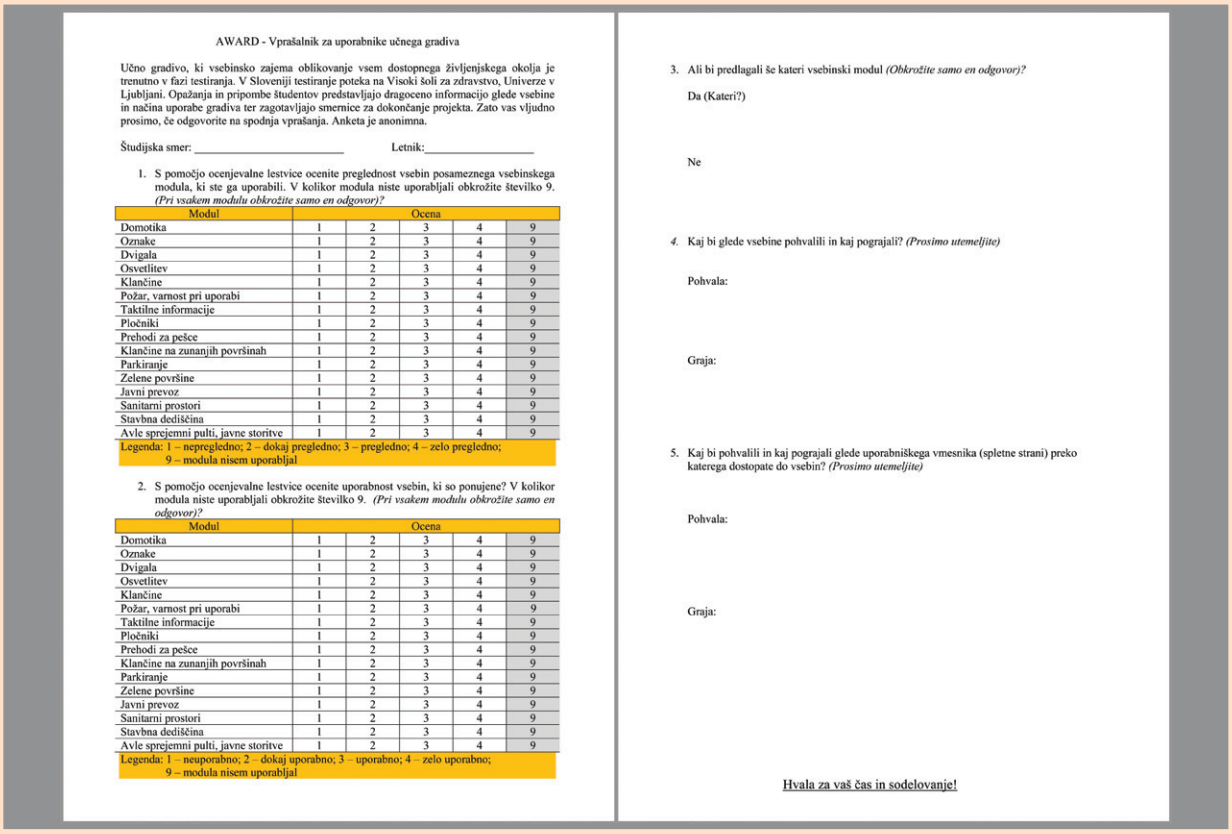


Figure 1:
Temporary interface uploaded on school server with translated available modules and active hypertext.



AWARD - Vprašalnik za uporabnike učnega gradiva

Učno gradivo, ki vsebinsko zajema oblikovanje vsem dostopnega življenjskega okolja je trenutno v fazi testiranja. V Sloveniji testiranje poteka na Visoki šoli za zdravstvo, Univerze v Ljubljani. Opažanja in pripombe študentov predstavljajo dragoceno informacijo glede vsebine in načina uporabe gradiva ter zagotavljajo smernice za dokončanje projekta. Zato vas vljudno prosimo, če odgovorite na spodnja vprašanja. Anketa je anonimna.

Študijska smer: _____ Letnik:_____

1. S pomočjo ocenjevalne lestvice ocenite preglednost vsebin posameznega vsebinskega modula, ki ste ga uporabili. V kolikor modula niste uporabljali obkrožite številko 9. *(Pri vsakem modulu obkrožite samo en odgovor)?*

Modul	Ocena				
Domotika	1	2	3	4	9
Oznake	1	2	3	4	9
Dvigala	1	2	3	4	9
Osvetlitev	1	2	3	4	9
Klančine	1	2	3	4	9
Požar, varnost pri uporabi	1	2	3	4	9
Taktilne informacije	1	2	3	4	9
Pločniki	1	2	3	4	9
Prehodi za pešce	1	2	3	4	9
Klančine na zunanjih površinah	1	2	3	4	9
Parkiranje	1	2	3	4	9
Zelene površine	1	2	3	4	9
Javni prevoz	1	2	3	4	9
Sanitarni prostori	1	2	3	4	9
Stavbna dediščina	1	2	3	4	9
Avle sprejemni pulti, javne storitve	1	2	3	4	9

Legenda: 1 – nepregledno; 2 – dokaj pregledno; 3 – pregledno; 4 – zelo pregledno; 9 – modula nisem uporabljal

2. S pomočjo ocenjevalne lestvice ocenite uporabnost vsebin, ki so ponujene? V kolikor modula niste uporabljali obkrožite številko 9. *(Pri vsakem modulu obkrožite samo en odgovor)?*

Modul	Ocena				
Domotika	1	2	3	4	9
Oznake	1	2	3	4	9
Dvigala	1	2	3	4	9
Osvetlitev	1	2	3	4	9
Klančine	1	2	3	4	9
Požar, varnost pri uporabi	1	2	3	4	9
Taktilne informacije	1	2	3	4	9
Pločniki	1	2	3	4	9
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Klančine na zunanjih površinah	1	2	3	4	9
Parkiranje	1	2	3	4	9
Zelene površine	1	2	3	4	9
Javni prevoz	1	2	3	4	9
Sanitarni prostori	1	2	3	4	9
Stavbna dediščina	1	2	3	4	9
Avle sprejemni pulti, javne storitve	1	2	3	4	9

Legenda: 1 – neuporabno; 2 – dokaj uporabno; 3 – uporabno; 4 – zelo uporabno; 9 – modula nisem uporabljal

3. Ali bi predlagali še kateri vsebinski modul *(Obkrožite samo en odgovor)?*

Da (Kateri?)

Ne

4. Kaj bi glede vsebine pohvalili in kaj pograjali? *(Prosimo utemeljite)*

Pohvala:

Graja:

5. Kaj bi pohvalili in kaj pograjali glede uporabniškega vmesnika (spletne strani) preko katerega dostopate do vsebin? *(Prosimo utemeljite)*

Pohvala:

Graja:

Hvala za vaš čas in sodelovanje!

Figure 2:
The questionnaire.

were very active in giving comments about modules and temporary interface uploaded on www site. According to first responses we assume that teaching material presents attractive, useful and comprehensive tool for students of Sanitary Engineering, Physiotherapy and Occupational Therapy. Validated usefulness of modules differs among the study programs. Modules that are closely related to the mission of study program are mostly validated as the most useful modules and vice versa. Feedback will be used for the improvement of teaching material. In the next phase of the project extracts for selected vocations will be prepared. The final versions of complete suit of teaching material will be prepared and disseminated [6].

RESULTS AND DISCUSSION

The main output of the project is a complete suit of electronic teaching material that is accessible in the DVD format. DVD format was selected because of its attractiveness, especially for young generations. It also includes videos, pictures and hypertexts that enable better presentation of selected topic.

At the end of the project the teaching material will be structured into three main axes (triple matrix system), i.e. environment, disability and vocation (Figure 3). The matrix system facilitates the search of information either via cross-sections on the basis of a relevant vocation and/or on the basis of disability and/or on the basis of a defined part of the environment [6]. Environment is divided into three main fields: the in-

door environments, the outdoor environments and the generic elements. The indoor spaces include specific information relevant for public buildings (such as hotels, restaurants, historical buildings) and also their active spaces (for example dining, kitchen, toilets). Outdoor environment includes the whole information that has to be considered for the design of buried free outside environment (i.e. public transport facilities, parking lots, pathways, sidewalks, curb ramps, pedestrian crossing, green areas). In the field of generic element all building elements (i.e. doors, corridors, windows) and building systems (i.e. assistive technology, automation, smart buildings, communication, signage) are included. Regarding to the International Classification of Functioning, Disability and Health produced by the World Health Organization [26] disabilities are classified as motor, visual, hearing and cognitive. In the field of vocation the trades that are responsible for design and execution of barrier free environment are included (for example bricklayer, locksmith, electrician, joiner, etc.).

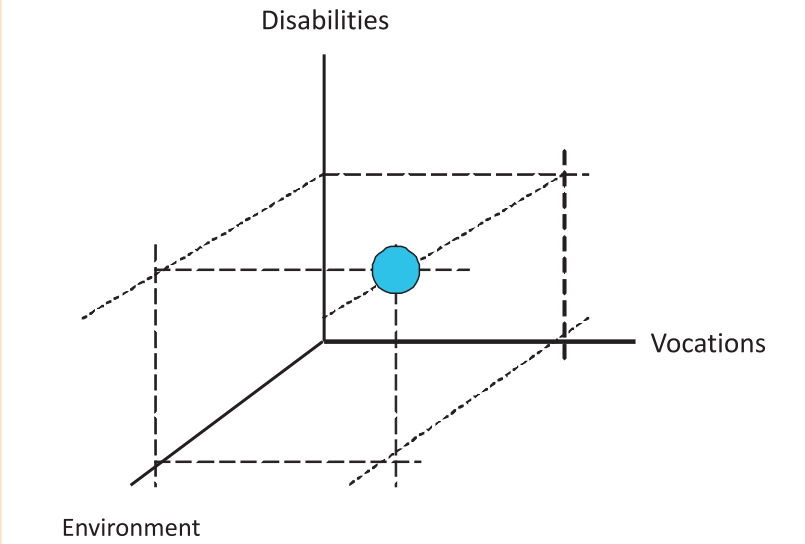

Figure 3:
Triple matrix system of environment, vocation and disability.

Figure 4 presents application interface for the navigation through the teaching material on a PC. On the basis of element or environment the information could be further searched through generic elements, outdoor environment and indoor spaces [6].

It is important to find data as quickly as possible. The way of searching relevant data also has to be simple. And even more, enormous amount of output data that are not relevant can decrease study motivation. Regarding that the possibility of crossing among chosen parameters that enables selective data search is introduced in the program. User (for example vocational student or individual learner) can select the combination of vocation, environment and disability. A possible combination might be: what should a plumber do in a bathroom for a person with visual impairment? This approach of searching can help the user to find only relevant information [6].

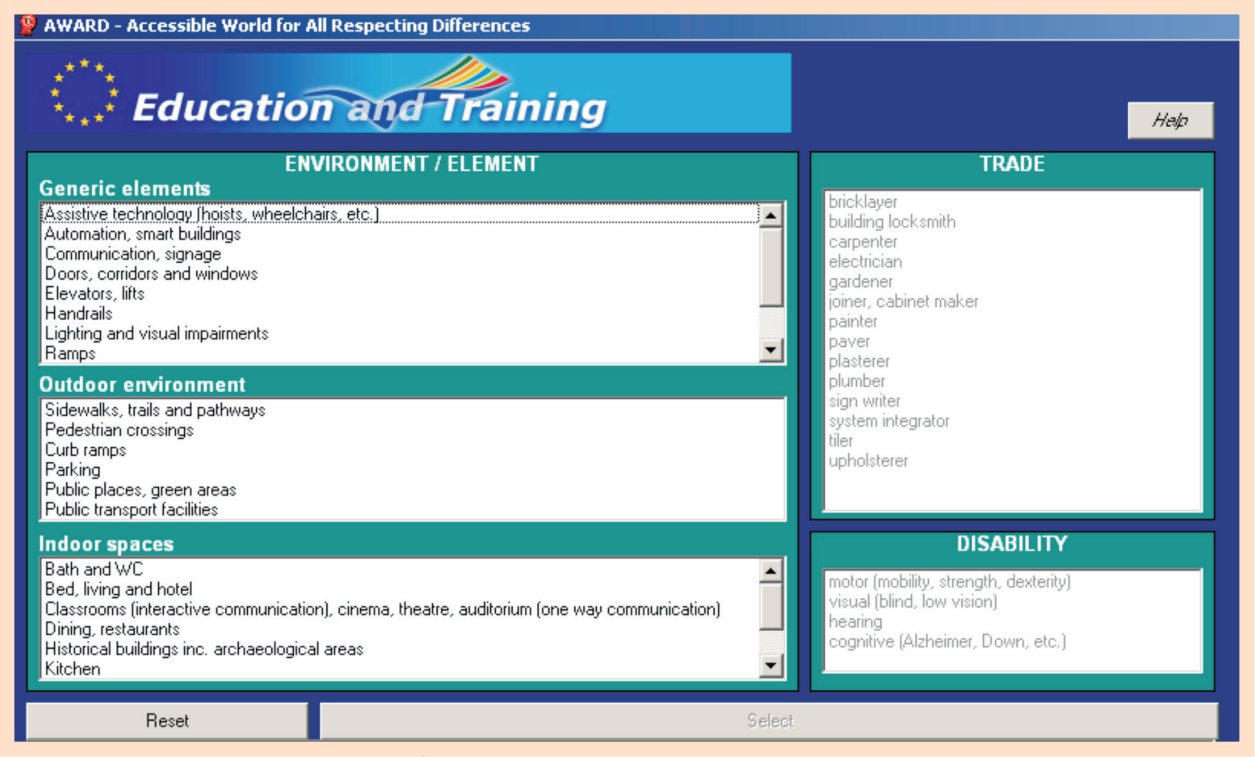

Figure 4:
Application interface for the navigation through the teaching material on a PC.

Teaching material is enriched with various illustrations, animations and video-clips where active participation of people with disabilities is recorded in various environments and situations. In such way the best practice, problems and standard solutions are clearly presented to the user [6]. Moreover, student ethnical approach and empathy are raised. Examples show manoeuvres with wheelchair user from different directions and from wheel-chair user's perspective to illustrate the problems of visual impairments, etc.

The teaching material is complemented by a handbook that is prepared as a guide. The handbook is meant to be used by teachers in the secondary schools for construction, building services, transports or/and other professional profiles involved in activities related to the built environment. The handbook enables the teacher to make his/her own teaching plan and also fulfil teaching goals. Beside teachers it may be used by any professional wishing to get basic information in universal design and also by people involved in activities related to the aspects deriving from these fields. It provides additional information about the design of built environment, further reading, regulation field and health considerations [6].

The teacher's handbook is divided into the two parts. The part one is a compendium of recommendations, results of research activities and national regulations acquired from the most advanced European, American and Asian authorities concerned with design and legislation in the above-mentioned domains. The part two presents the structure of the "AWARD" programme, the way it can be used and the results which may be obtained by the users.

User guide as additional part of teaching material presents a user's manual where the whole basic information about the use of material, its structure, directories and files are presented. It includes step-by step procedure that is clearly presented with active sheets.

Evaluation

In this section the main results of questionnaire analysis are presented. Figure 5 presents an example of analysis of comprehensibility and Figure 6 of usefulness and quality of information of various modules validated by students of physiotherapy, 1st year.

Students of physiotherapy were mostly observing and appreciating the modules that deal with problems they meet during their practical work and everyday life: Bath & WC and Lifts in indoor environment and Public transport and Pedestrian crossings in outdoor environment. It was expected that knowledge and interest of students in the first year of

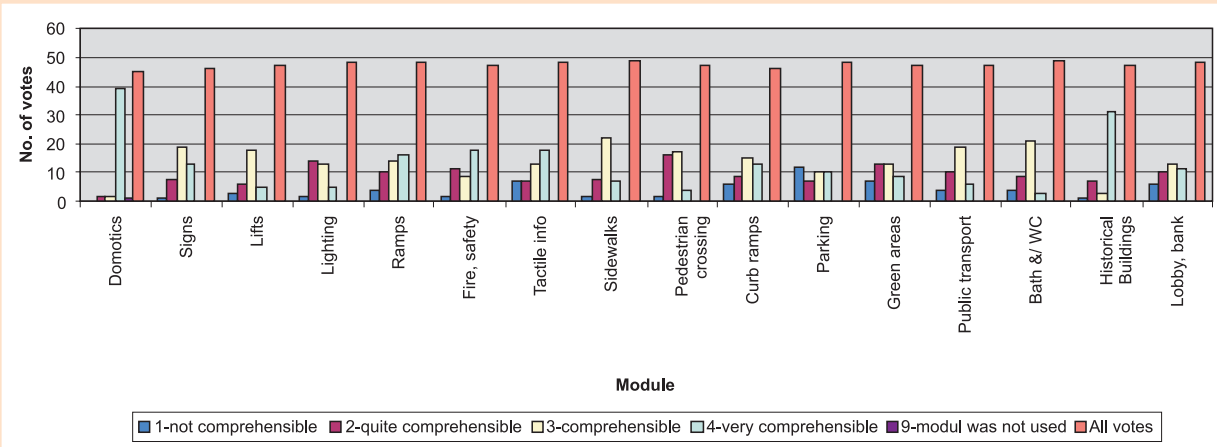

Figure 5:
Validated comprehensibility of modules by physiotherapists, 1st year (*N*=48).

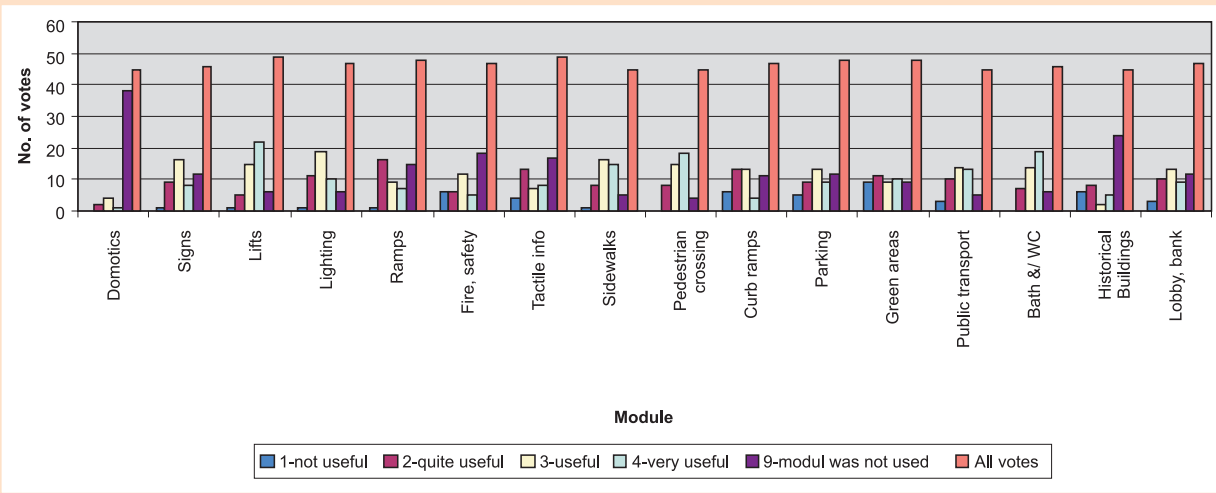

Figure 6:
Validated usefulness of modules by physiotherapists, 1st year (*N*=48).

their study would not be oriented toward special issues, like Domotics or Fire safety, but on common and basic fields.

Students of the 3rd year of sanitary engineering were mostly observing and appreciating the modules that deal with problems they meet during their lesions and practical work: they were mainly concerned with accessibility of indoor and outdoor environment. Students of the 4th year of sanitary engineering were mostly observing and appreciating the modules that deal with problems they meet during their lesions and practical work: they are mainly concerned with accessibility of indoor and outdoor environment and living and working conditions (safety, fire evacuation, lighting, noise, thermal conditions, health impacts, etc.).

Students of occupational therapy were mostly observing and appreciating the modules that deal with problems they meet during their practical work: Ramps, Sidewalks, Pedestrian Crossing, Bath & WC. Moreover, even the less used modules were quite highly evaluated (3.1-3.3). Regarding their knowledge and skills, it was expected that most of the modules would be very interesting for them. Students realized the importance of the presented material. However, occupational therapy presents a field of experts that work with disabled persons. During their study they evolve the empathy for their clients and in such way they can see the surrounding environment through the eyes of disabled persons.

It has to be emphasized that variations between the rated modules are very small and that they have to be observed in the context of study program, study year and course into which the students are involved.

It has to be emphasized that variations between the rated modules are very small and that they have to be observed in the context of study program, study year and course into which the students are involved. At the beginning of their study students are more interested in basic knowledge and students of senior years deal with more specialised knowledge. This is why some modules were used by most of the students and some only by a few of them.

The evaluations by particular groups of students are quite level. None of the evaluated modules differentiates from the average by more than 0.4 points. Between the highest and the lowest rated module the difference in a specific group is never larger than 1.0 point. This is partly due to their interest and partly due to their level of knowledge. We can also observe that students of physiotherapy and occupational therapy evaluated the teaching material through the eyes of user (disabled person), while the students of sanitary engineering evaluated it through designer/execution/control approach.

Students were quite active in the commenting of the modules. Individual comments (observations/suggestions) and opinions concerning the content and intermediate tool (commends/reprimands) can be organized into the following groups that re summarized in the Table 2.

After testing, the teaching material will be introduced to the regular courses of Sanitary Engineering. The assistant and professors will select the important modules from teaching material and include them into their lectures and practical training. In the 2nd year of Sanitary Engineering the material will be introduced into the course General and Communal Hygiene, where students will become familiar with basic terminology, principles and regulation field. In the 3rd year the material will be

Table 2:
Results of qualitative analysis of modules by sanitary engineers, 3rd year, 4th year, physiotherapists, 1st year, occupational therapists, 3rd year (*N*=21, 19, 48, 11).

Comments related to interface	Comments related to content of modules	Proposals
Pubic access from home. Distance learning possibility.	Short and to the point presentations of text. Good translation in Slovenian language. All technical material is concentrated in one place. Systematic, survey able. Synoptic arrangement of titles and other text. Pictures, videos from everyday life. Usefulness of information. Simplicity of definitions, easily understandable language. Table presentations. Easy readable. Fire safety module.	Add explanatory pictures close to title. More general examples. www address should be. easy to find Public advertisement.
	Differences of content between modules. No photos in some modules. Some modules include too much text.	

introduced into lectures and seminars of Sanitary techniques, Urbanization and Design. Students will become familiar with national and international legislation on the level of universal design. In the 4th year the material will be included in the Methods of Sanitary Engineering course and Bioclimatic Design course. Both courses present the application of their knowledge about Universal design. The practical training of Methods of Sanitary Engineering course is carried out as a field work in different public places such as public toilets, market halls, public transport facilities, heath care buildings, etc.

Different countries, different schools place emphasis either on the first or on the last approach. The aim of the consortium is to collect information on both philosophies and to alloy them in a form which fits best the conditions of the participants [6]. Observations and suggestions made by teachers and students will present valuable information regarding the content and the use of the material and will provide guidelines for the finalization of work. After evaluation the final material will be available on a DVD.

Because of the electronic form, the teaching material can also be used for individual learning. Education of all society (from developer, designer, building manager to the central government and local authorities) about universal design and raising the awareness of accessibility is important for opening minds and stimulating empathy concerning the creation of an accessible world for all [6].

The integration of people with disabilities into education, employment and everyday life is in the fundamental interest of the whole community. Safe and independent participation of people with disabilities in social, economic and cultural activities, rather than confinement in their homes, or institutional care, improves not only their quality of life, but also the general economic conditions of their families and of society as a whole [6].

The integration of people with disabilities into education, employment and everyday life is in the fundamental interest of the whole community.

Modules were validated as useful tool for broadening the knowledge about the Universal design not only of sanitary engineers, but also of physiotherapists and occupational therapists.

CONCLUSIONS

Teaching material in DVD format presents modern and attractive way of learning, especially for young generations. Good and bad practical examples presented by animations, video-clips and drawings help to get better and clear image about disability in build environment. All teaching material enriches the student's knowledge about the Universal design, they could realize the problem of buried un-free environment, and lost but not least, it enables to transform the theory into practise.

Education approach with distance learning process that is already in progress at the Faculty for Health Studies, University of Ljubljana, presents part of lifelong learning process. The main goal is to include all groups of people, without any discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation. However, sanitary engineers present very important part in the process of design, advice and supervision that helps raising the awareness in society, increasing the importance of the Universal design and leading to barrier free environment for all. Modules were validated as useful tool for broadening the knowledge about the Universal design not only of sanitary engineers, but also of physiotherapists and occupational therapists.

Observations and suggestions made by teachers and students present valuable information regarding the content and the use of the material and provide guidelines for the finalization of work. The AWARD project was completed in September 2009 [6].

The main output of the project is teaching material in national languages that includes a DVD and teacher's handbook. The published material will be freely available for students and also for the interested public. The teaching material is considered as a starting platform which can be further upgraded and developed according to new findings, technical solutions and regulative requirements.

It is expected that as a consequence of better education the result will be improved level of planning and execution of barrier free environment.

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Original scientific paper

Comparison of wooden (*Abies* spp.) and plastic trays for pasta drying

Rok **FINK**[1], Sebastjan **FILIP**[2], Mojca **JEVŠNIK**[1*]

ABSTRACT

Food quality and food safety are vital in processes where products are in contact with various materials. In case of dried egg pasta trays with wooden frames were used for centuries, however with development of different materials, wood was slowly abandoned and replaced by plastic. Nevertheless there are some hygienic considerations using plastic frames in the industry of the dried egg pasta. In this research plastic and wooden trays were analysed by swabbing (N=150) and compared by total number of aerobic counts using Petrifilm™. Results of this research showed that the total CFU/20 cm^2 for wood trays, are statistically measured significantly ($p< 0.001$) lower (38 times) than plastic trays independent from location of taken swab and that 28 % swabs on plastic frames exceeded 200 CFU/20 cm^2. Wood in food industry can be as much hygienic as plastic material on condition that is sanitised and maintained properly.

KEY WORDS:

Wood, Plastic, Microorganisms, Swabs, Pasta draying.

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INTRODUCTION

Food system is a complex, concentrated, and dynamic chain of activities it begins with production of raw agricultural commodities on farms, orchards, and ranches then moves to value added processes to manufactured products for the retail food stores and foodservice establishment where they are merchandised, prepared, and sold to costumers [1]. Regarding the role of sanitation and food safety in the food industry, it is important to understand the uniqueness of each sector of the food system [2]. Today we manage food safety through the good practices at different levels of food production, distribution and consumption. Present maintenance of food safety in food supply chain can be easily broken down, because of different kind of barriers or simple misunderstanding among stakeholders including consumers [3].

Regarding the role of sanitation and food safety in the food industry, it is important to understand the uniqueness of each sector of the food system.

Barriers can be broken during production, processing, preparation, service and transport, therefore any food may be exposed to biological, chemical or physical agents with the potential to cause the illness [4,5]. Processing failure, especially time and temperature abuse can allow survival and proliferation of pathogenic bacteria, moulds and toxins [6-9]. To prevent adverse health effect, surface sampling is a tool for the hygiene evaluation and the indicator of the contamination sources [10-16]. It is also an effective method in the Hazard Analysis Critical Control Point (HACCP) verification process for internal control of hygiene. For choosing a suitable method for the detection of the microorganisms it is important to know what kind of information is needed. Also it is important to figure out the wideness of sampling, the amount of samples and the frequency of sampling when choosing the method [17,18].

To prevent adverse health effect, surface sampling is a tool for the hygiene evaluation and the indicator of the contamination sources.

In the past, wood has been used as traditional material for many applications in food industry. Today wood is getting discriminated in many sectors, both in utensils, as interiors, and in buildings as well as in pallets and in packaging. There are some studies [19,20] on the hygienic properties of wood that confirm that wood is as good as other materials to use in the food industry [21,22]. In food industry of dried egg pasta (e.g. spaghetti, elbow macaroni, screw-shaped pasta, spirals, butterflies, shells, ribbons, etc.) producing wooden trays are used for drying the fresh pasta. Traditionally, wood especially oak was used, however with development of materials; particularly PET (polyethylene terephalate) materials wood was gradually replaced. The most difficult and expensive stage in the manufacture of pasta products is the drying process [23-25]. Drying of egg pasta is preservation process and it can be named as critical control point. The aim of drying is to reduce the content of water under the 13.5 % according to legislation. Since the migration of water from the internal to the external layers and so to the surface takes place by capillarity, the pasta must maintain an appropriate structure (porosity) in relation to its current moisture required by law. [26-28].

The wood has been used as traditional material for many applications in food industry.

METHODS

In this research wooden (*Abies* spp.) and plastic – PET trays for pasta drying were analysed by swabbing and compared due to allowed total number of microorganisms in such materials. In both cases 25 plastic and 25 wooden trays were tested. In each trolley, made form stainless steel 21 trays were inserted. Therefore the 1st, 11th and 21st trays were swabbed in area 20 cm^2. Each tray was swabbed at three different locations; net (2), shortest (1) and longest edge (3) (Figure 1). Sterile swabs on plastic stick made of cotton were prepared with 5 mL of sterile 0.9 % NaCl solution. Plastic and wooden trays were washed in the washing machine, fresh pasta was added on trays and dried 8 hours at average temperature of 63 °C and at the end of process swabs were sampled.

After the swabbing, swabs were shaken for 2 minutes, 1 mL of solution was added on Petrifilm™ Aerobic Count Plate. Plates were incubated 72 hours at 30 °C according to AFNOR Validated Method 3M 01/1-09/89 and then countered. The results of microbiological tests were processed by the repeated measures analysis using the General Linear Model (GLM) procedure [26]. The statistical model included the main

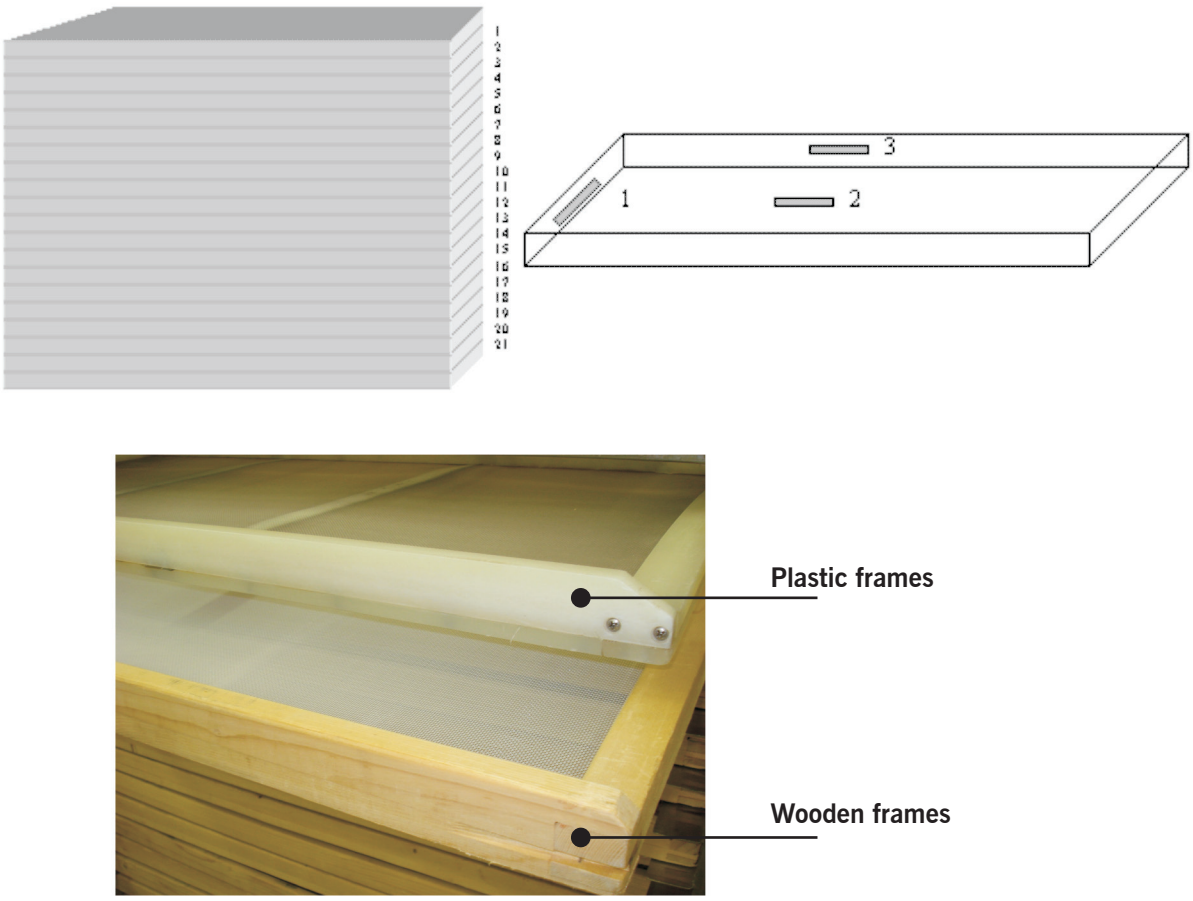

Figure 1:
Methodology of pasta trays swabbing.

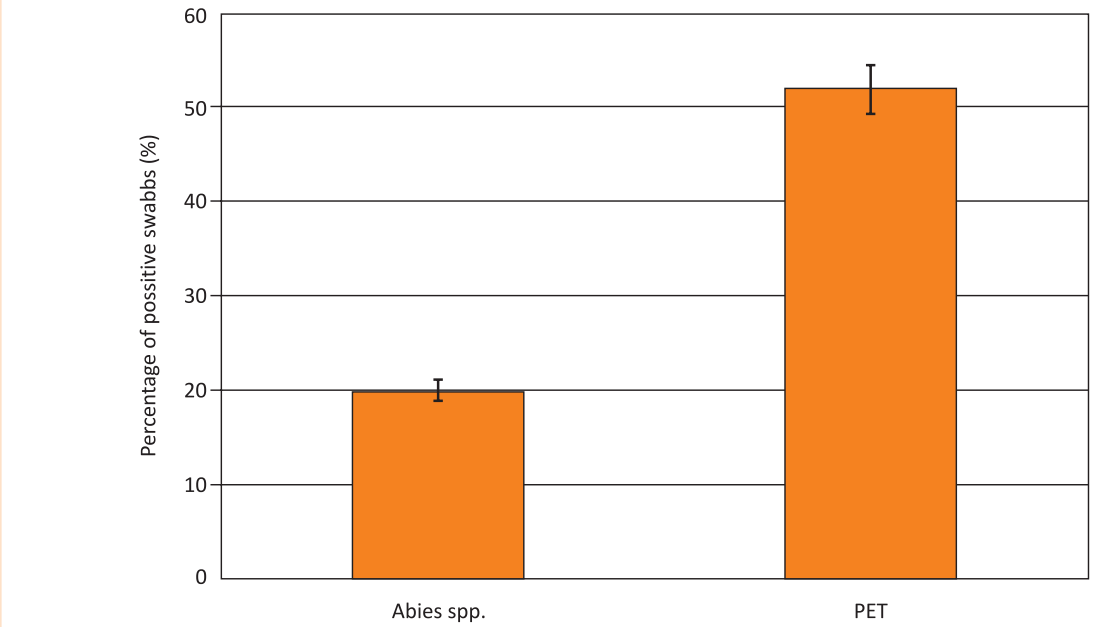

Figure 2:
Percentage of positive swabs taken from wood and PET materials.

effects material as well as the position of swab sampled. The least squares means that the experimental groups were obtained using the Least Square Means (LSM) procedure and were compared at the 5 % probability level [29].

The aims of the research were: (1) to evaluate total number of microorganisms on wood and on plastic material for pasta trays and (2) to make hygiene evaluation of analysed materials for application in pasta industry. The hypothesis was expressed as 'Does the material of tray and/or the location of sampled swab have influence on colony forming unit (CFU) /20 cm^2?"

RESULTS AND DISCUSSION

In the Table 1 results from total aerobic counts from swabs sampled from two types of trays made from different materials are given; for wood and for plastic material.

Total CFU/20 cm^2 for the wood trays is statistical significant lower (38 times) than plastic trays independent from location of the sampled swab. According to location of swab it can be confirmed that the material of tray have significant influence on CFU ($p \leq 0.001$). CFU from location 1 and 3 are statistical different depending on material of tray since the material of tray frame is different (wood or plastic). While location 2 represent the results from swab sampled from net that represent the ground from tray and is in both cases made from the same material and the difference is not significant ($p \geq 0.05$), therefore location 2 can be presented as control group. The Figure 2 shows that 20 % of swabs sampled from wood were positive, meanwhile from plastic one more than half (52 %). According to the Law on specific measures in food poisoning and their prevention, Slovenian official Gazette No.

Table 1:
Results of CFU on wooden and plastic pasta t

Parameter	Material		Statistic parameter	
CFU/20 cm^2 (mean values)	wood n = 75	plastic n = 75	p-value	Significance
Total, n = 150	1.26^a	38.73^b	0.000139	***
Location 1, n = 50	1.60^a	9.80^b	0.000886	***
Location 2, n = 50	1.00^a	1.60^a	0.343518	NS
Location 3, n = 50	1.00^a	106.8^b	0.000042	***

CFU colony forming unit, n number of observation, *** Significant at $p \leq 0.001$; ** significant at $p \leq 0.01$; * significant at $p \leq 0.05$; NS not significant ($p > 0.05$), Values in a row followed by a different letter are significantly different in the Duncan (0.05) test rays.

24/1981 the maximum number of total bacteria is 200 per 20 cm^2. In case of wood and net, none of the swabs exceeded maximum level, but 28 % swabs on plastic trays exceeded this level.

Beside the hygroscopic properties of wood the high content of extractives in certain species e.g. pine proved to have a good antibacterial effect.

Schönwälder at al [19] pointed out that there seem to be evidence that pine and especially heartwood of pine is superior to other frequently used species. Beside the hygroscopic properties of wood the high content of extractives in certain species e.g. pine proved to have a good antibacterial effect. Nevertheless Beyer et al [21] showed that not only the wood species but also the wood moisture is decisive for the extent of hygiene in connection with food. Increasing wood moisture implies better conditions of life for bacteria, so dry conditions are the way to prevent bacterial growth. Contrariwise Gough and Dodd [6] studied survival and disinfection of *Salmonella typhimurium* on chopping board surfaces of wood and plastic and found out that there was no significant difference between wood and similarly treated plastic surfaces. Meanwhile Milling et al [30] studied microbial survival on pine (*Pinus silvestris*) larch (*Larix decidua*) and maple (*Acer pseudoplatanus*) wood which are commonly used in Europe, found out that total number of bacteria on wood is smaller compared to the plastic. Different bacterial species showed a completely different survival on the rates on wooden samples followed by enterococci and streptococci [30].

From technological point of view plastic is unsuitable since is twisting, expanding and shrinking under drying room conditions.

And since in drying room extreme conditions are present, a material used is such processes must be durable. From technological point of view plastic is unsuitable since is twisting, expanding and shrinking under drying room conditions. In heating stage of draying process plastic trays can expand so intensively that cannot be moved in trolley but on the other hand in stage of cooling they are shrinking so that thay can fall out of trolley. Nevertheless the plastic trays are also heavier than wood what represent unnecessary burdening for workers. On market it can be found also trays made of aluminium which are lighter but costs are extremely high. Wooden trays are more rigid and more resistant to conditions changes and are also lighter. Average air temperature in drying chamber is 65 °C. Time of drying vari due to pasta type, however it is between 6 hours to 14 hours and relatively humidity is decreased from 28 % – 34% to lower than 12 %. The water activity in final prod-

Wooden trays are more rigid and more resistant to conditions changes and are also lighter.

uct is lower than 0.6 [31]. Nevertheless if the wood is used in food industry it has to be cleaned and maintained properly to minimize not only microbiological, but also chemical and physical hazards in process of food making.

CONCLUSION

Food safety is furthermore nutritional value and sensory, one of foundation for food quality parameters. In process of producing, food can be in contact with various materials, therefore is vital, that substance do not influence the product. The use of wood has however decreased, and other materials like plastic, stainless steel and aluminium have taken its place. The reason for this negative development seems to be declining market demands, partly caused by legislation in Europe and elsewhere [22]. There are several studies which results show that wood can be as hygienic as others materials and even more, some species of wood have antimicrobial property [19-21,30]. This study proved the hypothesis, that material has influence on CFU, since on plastic frames for pasta trays much more microorganisms are developed than on wooden ones ($p<0.001$) and that on net that is in both cases made of the same material, difference is not significant ($p>0.05$). Although analysed PET material is made purposely for food industry one third of swabs exceeded maximum level of 200 CFU and more than half were positive. For this reason materials used in process of pasta making must be on one hand durable, but on the other assure safety of final product and wooden trays showed great potential.

Materials used in process of pasta making must be on one hand durable, but on other assure safety of final product and wooden trays showed great potential.

In further research not only total aerobic count, but also bacterial species should be identified and also physical and chemical properties of the selected materials.

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Orodje za zagotavljanje varnosti živil – sistem RASFF

RASFF as the tool for ensuring food safety

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POVZETEK

Zagotavljanje varnosti in kakovosti hrane je tako v EU kot tudi globalno pomemben element v skrbi za človekovo zdravje. Za dosego tega cilja je potrebno usklajeno delovanje zakonodajnih, nadzornih in znanstvenih institucij. V prispevku je predstavljen evropski zakonodajni okvir na področju zagotavljanja varne hrane, dejavniki tveganj v živilih in delovanje sistema hitrega obveščanja za živila in krmo (RASFF), ki ob izkoriščanju komunikacijskih danosti sodobnega časa in s sodelovanjem članic EU pa tudi širše, predstavlja ključno orodje zagotavljanja sledljivosti živil in izdelkov ter zagotavlja osveščenost končnega potrošnika. Predstavljeni so rezultati učinkovitosti sistema RASFF, in sicer število objav vključno z dodatki sistema obveščanja za živila in krmo (RASFF) od 1997 do 2008 ter delež alarmnih in informacijskih obvestil po skupinah izdelkov od leta 2002 do 2008. Pregled alarmnih in informacijskih obvestil glede na vzrok umika/odpoklica v primeru mikrobiološkega in kemijskega onesnaženja kaže pozitivne učinke uvedbe notranjega nadzora na načelih sistema HACCP v evropsko zakonodajo.

KLJUČNE BESEDE:

varnost živil, RASFF, tveganja.

ABSTRACT

Ensuring food safety and quality is, in the EU and globally, an important element in the care for the public health. To achieve this objective, harmonized action of different partners (legislative, regulatory and scientific institutions) is needed. This paper presents the European legislative framework in the field of food safety, food risk factors and the operation of the Rapid Alert System for Food and Feed (RAFF), which is, by utilizing the communication advantages of modern time and cooperation of the EU members and beyond, a key tool to ensure food respectively product traceability and awareness of the final consumer. The results present the RASFF system effectiveness including number of system notifications with supplements from 1997 to 2008 and the proportion of alert and information notifications according to product groups from 2002 to 2008. The overview of alert and information notifications regarding the cause of the withdrawal/recall of food products shows positive effects of internal control system on the principles of HACCP as a component of EU legislation in case of microbiological and chemical contamination.

KEY WORDS:

Food safety, RASFF, Risk.

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Usklajeno delovanje zakonodajnih, nadzornih in znanstvenih institucij zagotavlja, da so živila varna in dobre kakovosti in da se ob vsakem sumu o zdravstveni neustreznosti živila, kjerkoli v EU sproži sistem hitrega obveščanja za živila in krmo (ang. Rapid Alert System for Food and Feed – RASFF).

UVOD

Skrb za zdravje ljudi je danes eden izmed glavnih ciljev razvitih dežel in je v neposredni povezavi z zagotavljanjem zdrave in varne prehrane. V živilsko-prehransko-oskrbovalni verigi obstajajo različna tveganja, ki vzpodbujajo proizvajalce na različnih stopnjah verige, da prepoznajo tveganja, jih odpravijo ali jih vzdržujejo na sprejemljivi ravni z namenom zagotavljanja zdravstveno ustreznega živila. Zavedanje ljudi o tveganjih, povezanih z živili narašča, tako pri nas kot drugod v svetu. Za najuspešnejšo metodo zagotavljanja varnih živil se je izkazal sistem Hazard Analysis and Critical Control Point (HACCP), ki je v Sloveniji obvezen od 1. januarja 2003, v državah članicah Evropske unije (EU) pa od 1. januarja 2006 [1-3]. Usklajeno delovanje zakonodajnih, nadzornih in znanstvenih institucij zagotavlja, da so živila varna in dobre kakovosti in da se ob vsakem sumu o zdravstveni neustreznosti živila, kjerkoli v EU sproži sistem hitrega obveščanja za živila in krmo (ang. Rapid Alert System for Food and Feed – RASFF). Za zaščito potrošnikov in živali je EU pred 30 leti vzpostavila sistem hitrega opozarjanja na nevarnosti hrane in krme, v katerem si države članice lahko hitro izmenjujejo informacije o morebitnih nevarnih izdelkih in ustrezno ukrepajo. Sistem opozarjanja EU o nevarnosti v zvezi z živili zagotavlja, da nevarna živila in krma ne pridejo v prehransko verigo [4]. Poleg zagotavljanja zdravstvene ustreznosti živil je vloga omenjenega sistema tudi zagotavljanje sledljivosti živil v vsej živilsko-prehransko-oskrbovalni verigi ter dobra obveščenost potrošnikov. Predpisi, ki obravnavajo varnost živil, so oblikovani na osnovi neodvisnih znanstvenih ugotovitev, uveden je tako sistem nacionalnega kot tudi mednarodnega nadzora zdravstvene ustreznosti živil.

Zakonodaja na področju varnosti živil

Področje varnosti hrane in krme v EU je bilo v preteklosti urejeno s številnimi direktivami. Praksa pa je pokazala, da so države članice vsebino direktiv prenašale v svoj nacionalni pravni red neenotno. Hkrati se je zaupanje evropskih potrošnikov v varnost hrane zmanjšalo zaradi afer znotraj skupnega trga EU (BSE[1], dioksinska afera itd.). Da bi se povečala varnost hrane in krme v celotni proizvodni verigi živil "od njive do mize", da bi se lažje in hitreje odkrivale nepravilnosti ter da bi bilo to področje v državah članicah EU urejeno enotneje, so uradniki EU skupaj z državami članicami EU pripravili nov zakonodajni okvir, t.i. "higienski paket" na področju hrane in krme, ki ga sestavlja pet uredb EU, sprejetih v obdobju od leta 2002 do leta 2005 [5]. Po letu 2005 so bile spodaj navedene uredbe večkrat dopolnjene, zato navajamo samo povzetek zahtev osnovnih uredb.

Uredba (ES) št. 178/2002 Evropskega parlamenta in Sveta, izdana 28. januarja 2002 [3], podaja splošna načela in zahteve živilske zakonodaje v celotni proizvodni verigi hrane in krme za celotno območje EU in ustanavlja Evropsko agencijo za varno hrano (EFSA[2]). Pomembna zahteva te uredbe je zagotavljanje sledljivosti v vseh fazah proizvodnje. EFSA je od politike, Evropske komisije in držav članic EU neodvisna organizacija. Njena naloga je, da z neodvisnimi strokovnjaki, ki sodelujejo v različnih

1 Goveja ali bovina spongiformna encefalopatija (BSE) je subakutna degenerativna bolezen centralnega živčnega sistema odraslih govedi, ki so jo leta 1986 prvič opisali v Veliki Britaniji. Je ena od prenosljivih spongiformnih encefalopatij (TSE) ali prionskih bolezni. Za te bolezni je značilna dolga inkubacijska doba in kopičenje nenormalne izooblike prionskega proteina (PrP^{Sc}) v centralnem živčevju. PrP^{Sc} se od normalnega celičnega prionskega proteina (PrP^{C}) razlikuje po večji odpornosti na delovanje proteaz.

2 European Food Safety Agency

znanstvenih odborih in znanstvenih svetih EFSE pripravi stališča in mnenja o različnih znanstvenih in tehničnih vprašanjih, povezanih z oceno tveganja. Kadar obstaja sum resnega neposrednega ali posrednega tveganja za zdravje ljudi, ki izhaja iz hrane ali krme, je EFSA kontaktna točka za čim hitrejši pretok informacij. V sistem hitrega obveščanja so vključene EFSA, Evropska komisija in kontaktne točke za hitro obveščanje držav članic.

Kadar obstaja sum resnega neposrednega ali posrednega tveganja za zdravje ljudi, ki izhaja iz hrane ali krme, je EFSA kontaktna točka za čim hitrejši pretok informacij.

Uredba (ES) št. 852/2004 Evropskega parlamenta in Sveta o higieni živil je bila izdana 29. aprila 2004 [2] in določa splošna pravila higiene živil za nosilce živilske dejavnosti v celotni živilski verigi, začenši s primarno proizvodnjo, ter se uporablja v vseh stopnjah proizvodnje, predelave in razdeljevanja hrane.

Uredba (ES) št. 853/2004 Evropskega parlamenta in Sveta z dne 29. aprila 2004 o posebnih higienskih pravilih za živila živalskega izvora [6] obvezuje vse nosilce živilske dejavnosti registrirati obrate primarne proizvodnje, predelave in razdeljevanja hrane pri pristojnih oblasteh.

Uredba (ES) št. 882/2004 Evropskega parlamenta in Sveta z dne 29. aprila 2004 o izvajanju uradnega zdravstvenega nadzora [7] zagotavlja preverjanje skladnosti z zakonodajo o krmi in živilih ter s pravili o zdravstvenem varstvu živali in zaščite živali. Določa tudi splošna pravila za izvajanje uradnega nadzora z namenom varovanja zdravja živali in ljudi ter varstvo potrošnikov pred zavajanjem in potvorbami, vezanimi na različne vrste hrane. Država članica mora organizirati uradni nadzor, ki mora biti reden in se izvajati ustrezno pogosto, kar temelji na prepoznanih tveganjih, izkušnjah in znanju, zanesljivosti notranjega nadzora oziroma kontrol nosilcev dejavnosti ter sumu o neskladnosti, ter se izvajati praviloma brez predhodnega obvestila. Uredba določa tudi nadzor nad uvozom iz tretjih držav.

Država članica mora organizirati uradni nadzor, ki mora biti reden in se izvajati ustrezno pogosto, kar temelji na prepoznanih tveganjih, izkušnjah in znanju, zanesljivosti notranjega nadzora oziroma kontrol nosilcev dejavnosti ter sumu o neskladnosti, ter se izvajati praviloma brez predhodnega obvestila.

V skladu z Uredbo o koordinaciji delovanja ministrstev in njihovih organov v sestavi, s pristojnostmi na področju varnosti hrane oziroma živil pri vključevanju v proces analize tveganja deluje v okviru Zdravstvenega inšpektorata Republike Slovenije (ZIRS) v Sektorju za strategijo, metodologijo in načrtovanje (SSMP) nacionalna kontaktna točka (NKT) v sistemu hitrega obveščanja za živila in krmo – RASFF. Delovanje NKT mora biti vzpostavljeno na način, da izpolnjuje vse zahteve, opredeljene v členih 50 in 53 Uredbe 178/2002 Evropskega parlamenta o določitvi splošnih načel in zahtevah živilske zakonodaje, ustanovitvi Evropske agencije za varnost hrane in postopkih, ki zadevajo varnost hrane [8].

NKT aktivno sodeluje pri izmenjavi informacij o živilih in krmi, ki niso varni s kontaktno točko pri Evropski Komisiji in z nacionalnimi kontaktnimi točkami ostalih držav članic EU. Prav tako koordinira in sodeluje pri izmenjavi informacij v okviru Slovenskega sistema obveščanja, v katerem delujejo še Veterinarska uprava RS, Inšpektorat RS za kmetijstvo, gozdarstvo in hrano in Inšpektorat RS za okolje in prostor. ZIRS zagotavlja stalno delovanje RASFF sistema in sicer 24 ur na dan vse dni v letu. Izven delovnega časa so organizirana dežurstva, ki zagotavljajo stalno dosegljivost dežurnega inšpektorja [8].

Tveganja je težko razvrstiti po pomembnosti, vsekakor pa se mikrobiološka tveganja razlikujejo od fizikalnih in kemijskih po tem, da se med potovanjem živila skozi živilsko verigo lahko še dodatno "namnožijo" in s tem prizadenejo večjo populacijo ljudi.

DEJAVNIKI TVEGANJ V ŽIVILIH

V proizvodnji in prometu živil obstaja vrsta tveganj, ki zavezujejo in vzpodbujajo nosilce živilskih dejavnosti, da tveganja prepoznajo in jih z ustreznimi metodami in tehnikami obvladujejo in zagotavljajo njihovo sledljivost vse do potrošnika. Potrošnik, kot enakovredni člen živilsko-prehransko-oskrbovalne verige, je prav tako dolžan upoštevati načela dobre prakse pri delu z živili doma. Tveganja na poti od polja do mize po kateri potuje surovina, polizdelek ali končni izdelek delimo v tri glavne skupine: biološka, fizikalna in kemijska tveganja. Vsaka skupina tveganj ima specifične lastnosti, zato je tako v znanstvenih kot strokovnih krogih deležna specifične teoretične in analitične obravnave. Tveganja je težko razvrstiti po pomembnosti, vsekakor pa se mikrobiološka tveganja razlikujejo od fizikalnih in kemijskih po tem, da se med potovanjem živila skozi živilsko verigo lahko še dodatno "namnožijo" in s tem prizadenejo večjo populacijo ljudi oziroma so njihovi učinki akutni in usodnejši. V nadaljevanju so na kratko povzete značilnosti posameznih dejavnikov tveganj [9].

Mikrobiološki dejavniki tveganj

V živilu ne smejo biti prisotni mikroorganizmi, ki predstavljajo tveganje za človekovo zdravje. To so bakterije, paraziti, protozoe, praživali, virusi, kvasovke in plesni. Vir teh organizmov so največkrat surovine in človek. Mikroorganizmi lahko povzročijo številne bolezni in celo smrt. Število in vrste bakterij so v različnih živilih lahko različne. Med tehnološkim procesom se lahko surovine in izdelki dodatno onesnažijo (sekundarna kontaminacija), če ne upoštevamo načel dobre higienske in proizvodne prakse. Z ustreznimi postopki dela je potrebno preprečevati okužbo, preživetje in razmnoževanje bakterij. Večino mikroorganizmov uničimo ali inaktiviramo s tehnološkim procesom oz. znižamo njihovo število na sprejemljiv nivo z upoštevanjem načel dobre higienske prakse. Za ohranjanje zdravstvene ustreznosti živil je o tudi po tehnološkem procesu potrebn z živilom ravnati tako, da preprečimo možnost naknadnega onesnaženja. Potrebno je poskrbeti za ustrezno embaliranje, shranjevanje, transport in končno distribucijo živil.

Večino mikroorganizmov uničimo ali inaktiviramo s tehnološkim procesom oz. znižamo njihovo število na sprejemljiv nivo z upoštevanjem načel dobre higienske prakse.

Kemijski dejavniki tveganj v živilih

Kemijske snovi lahko vstopajo v živilo v katerikoli fazi živilske verige, od primarne proizvodnje do končnega proizvoda. Kemične snovi so lahko dejavnik tveganja za zdravje ljudi, kadar so prisotne v živilu kot onesnaževalo ali pa so prisotne v živilu kot posledica nepravilne ali nedovoljene uporabe agrotehničnih sredstev (pesticidi), dodatkov živil (aditivi, pomožne predelovalne snovi) ali veterinarskih zdravil, uporabljenih za zdravljenje živali, namenjenih za hrano. Po definiciji je onesnaževalo vsaka kemična substanca, ki je nenamensko prisotna v živilu. Torej so kemična onesnaževala lahko posledica njihove prisotnosti v naravnem okolju ali onesnaženja naravnega in industrijskega okolja, lahko pa se v živilu pojavljajo sekundarno, v procesu predelave (migracija kemijskih snovi v živilo iz opreme, embalaže, uporabljenih čistil) ali pa se lahko

Po definiciji je onesnaževalo vsaka kemična substanca, ki je nenamensko prisotna v živilu.

onesnaževalo pojavi kot posledica tehnoloških postopkov, katerim so podvržena živila (npr. visoki temperaturi). Ostankov pesticidov, veterinarskih zdravil in aditivov ter pomožnih predelovalnih snovi ne uvrščamo med "prava" onesnaževala, kajti njihovi ostanki oziroma prisotnost v živilih v koncentracijah pod zakonsko postavljenimi mejnimi vrednostmi je pričakovana in v normalnih pogojih njihove uporabe in ni škodljiva za zdravje. Te snovi uvrščamo v onesnaževala le v primeru, če njihova uporaba ni dovoljena ali pa je na osnovi novih strokovnih dognanj ugotovljeno, da dovoljene snovi dolgoročno predstavljajo tveganje za zdravje, oziroma kadar presegajo zakonsko določene mejne vrednosti. Področje kemijskih dejavnikov tveganja je zakonsko regulirano z vrsto predpisov, ki opredeljujejo mejne vrednosti za posamezna onesnaževala in kemične snovi katerih uporaba v proizvodnji živil je dovoljena. Kemijski dejavniki tveganja so: pesticidi, aditivi (konzervansi, antioksidanti, emulgatorji, stabilizatorji, sinergisti, barvila, arome, umetna sladila), veterinarska zdravila, težke kovine (svinec, kadmij, živo srebro, arzen), industrijski klorirani ogljikovodiki (dioksini, furani, dioksinom podobni PCB-ji), mikotoksini (aflatoksin, ochratoksin A, fusarium toksini, patulin), procesna onesnaževala (poliaromatski ogljikovodiki, semikarbazid, 3-MCPD, akrilamid), histamin, čistila in razkužila.

Področje kemijskih dejavnikov tveganja je zakonsko regulirano z vrsto predpisov, ki opredeljujejo mejne vrednosti za posamezna onesnaževala in kemične snovi katerih uporaba v proizvodnji živil je dovoljena.

Fizikalni dejavniki tveganj

Med najbolj znane fizikalne dejavnike tveganja v živilih, vključujemo mehanske tujke, ki lahko povzročijo obolenje ali poškodbe pri ljudeh (vreznine, zlom zob, dušenje, itd.). Fizikalni/mehanski delci so dejavniki tveganja takrat, ko tujek, ki ni namensko prisoten v živilu, vstopi v živilo zaradi onesnaženja v katerikoli fazi živilske verige. Ti tujki so lahko iz kovine, stekla, umetne mase, lesa, insekti, kosti, tujki iz kovine – po izvoru so lahko odlomljen del proizvodnje opreme, del osebnega nakita ali oblačil oseb, ki delajo z živili (deli nakita, kovinski gumbi itd.), tujki iz lesa – izvor so lahko palete, lesene delovne površine, škatle, zabojniki, tujki iz stekla – izvor so lahko steklena embalaža, steklena posoda, luči in drugo, tujki iz plastike – njihov izvor so lahko kuhinjska oprema in pribor, embalaža, kamniti delci se lahko nahajajo v surovinah, poškodovanih stenah, tleh itd., kosti se lahko nahajajo v surovinah (mehansko izkoščičevanje mesa).

Med fizikalne dejavnike tveganja uvrščamo tudi onesnaženje živil z radioaktivnimi elementi. Njihov izvor je naravno okolje, eksplozija nuklearnega orožja, nezgode v jedrskih reaktorjih, nepravilno ravnanje z radioaktivnimi odpadki v medicinskih ustanovah, kot tudi nepravilno izvajanje sicer dovoljenega obsevanja živil z radioaktivnimi elementi, ki je namenjeno zagotavljanju mikrobiološke varnosti živil in preprečevanju zgodnjega kvara.

Med fizikalne dejavnike tveganja uvrščamo tudi onesnaženje živil z radioaktivnimi elementi.

SISTEM HITREGA OBVEŠČANJA ZA ŽIVILA IN KRMO

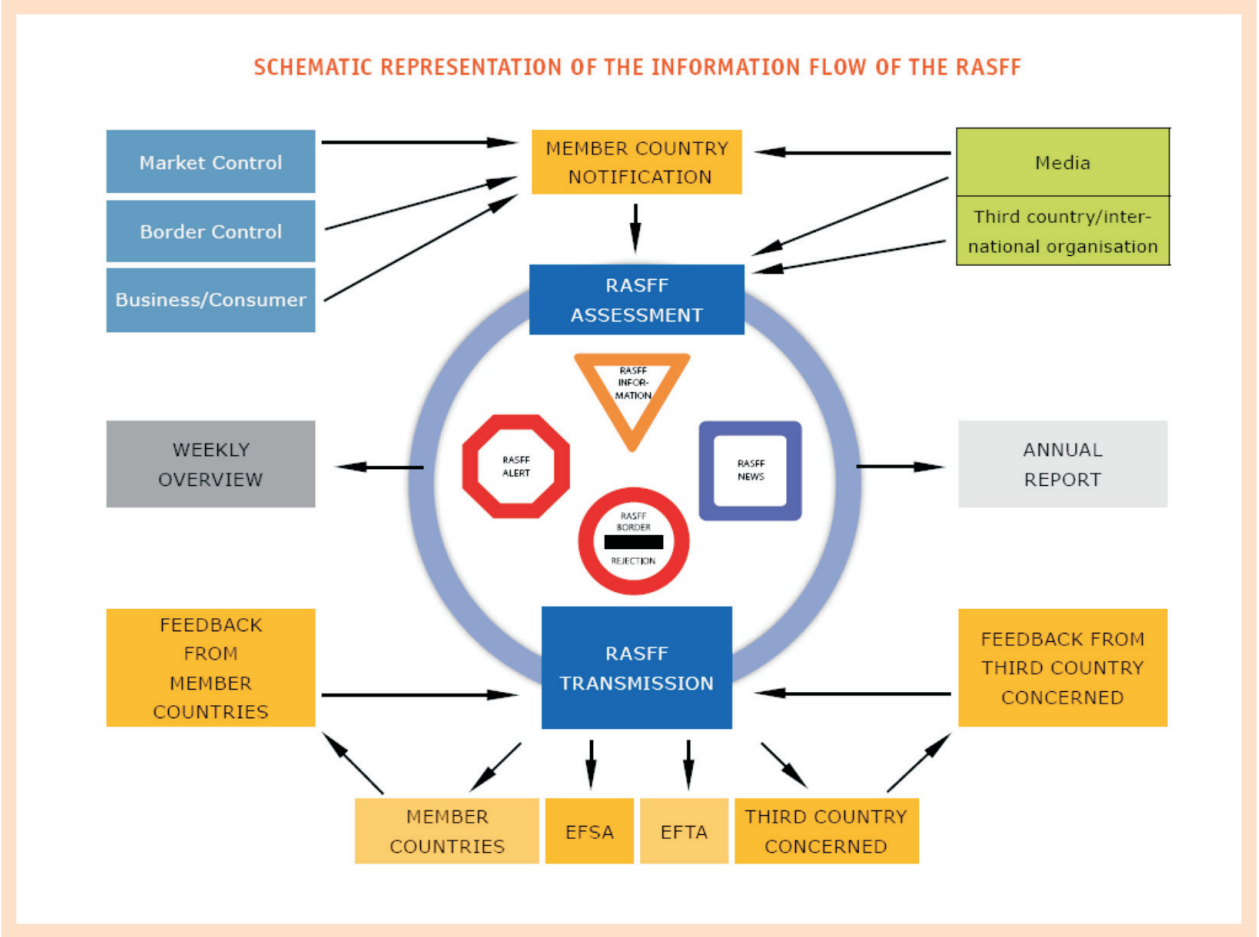
Sistem hitrega obveščanja za živila in krmo (RASFF) omogoča hitro in učinkovito izmenjavo informacij med državami EU, kadar se ob pomoči katerega od nazornih mehanizmov ugotovi, da v verigi živil in krme

V RASFF Republike Slovenije, se organi, pristojni za inšpekcijski nadzor, vključujejo preko kontaktnih točk (KT).

obstaja tveganje za človekovo zdravje. Vse članice sistema RASFF (EU-27, Komisija, EFSA, Norveška, Kneževina Liechtenstein in Islandija) imajo tako službe oz. nacionalne kontaktne točke za zagotovljanjr pošiljanja, sprejemanja in obravnavanja nujnih uradnih obvestil. Skladno z določbami Uredbe o koordinaciji delovanja ministrstev in njihovih organov s pristojnostmi na področju varnosti hrane oziroma živil pri vključevanju v analize tveganja [10] opravlja ZIRS tudi naloge nacionalne kontaktne točke, preko katere se Slovenija vključuje v EU sistem RASFF in služi prenosu informacij o problematiki na področju varnosti hrane oziroma živil ter omogoča hitro in učinkovito informiranje in ukrepanje vseh pristojnih organov.

V RASFF Republike Slovenije, se organi, pristojni za inšpekcijski nadzor, vključujejo preko kontaktnih točk (KT). Za delovanje posamezne KT v skladu s predpisanimi postopki je odgovoren predstojnik organa. Predstojnik organa s sklepom imenuje pooblaščene osebe v KT in opredeli njihove odgovornosti in pristojnosti. Nacionalni sistem hitrega obveščanja za živila in krmo se preko nacionalne kontaktne točke vključuje v EU sistem hitrega obveščanja živila in krme (EU RASFF). Nacionalna kontaktna točka za EU RASFF deluje pri Zdravstvenem inšpektoratu Republike Slovenije [10].

Slika 1:
Shematski prikaz pretoka informacij znotraj sistema RASFF na evropskem nivoju [11].



Legenda:
EFSA – European Food Safety Agency;
EFTA – European Free trade Association

Organi, pristojni za inšpekcijski nadzor, ki so povezani v sistem inšpekcijskega nadzora na področju varnosti hrane oziroma živil zagotavljajo usklajeno sodelovanje:

- z doslednim upoštevanjem pravil, predpisanih s poslovnikom sodelovanja organov, pristojnih za inšpekcijski nadzor na področju varnosti hrane oziroma živil, v sistemu inšpekcijskega nadzora in sistemu hitrega obveščanja za živila in krmo vključno s pravili delovanja v sistemu hitrega obveščanja za živila in krmo,
- z rednimi mesečnimi sestanki predstojnikov teh organov v okviru odbora za nadzor trga za živilske proizvode, ki delujejo pri svetu glavnih inšpektorjev;
- z izrednimi posveti predstojnikov v nujnih primerih za reševanje nujne tekoče problematike;
- z uskladitvijo letnih programov nadzora, skupno s programi vzorčenj;
- z redno mesečno izmenjavo podatkov o problematiki, ugotovljeni pri nadzoru, vključno z rezultati vzorčenja;
- s pripravo skupnega letnega poročila;
- s skupnim obveščanjem javnosti o ugotovitvah in ukrepih.

Pravna podlaga za hitri alarmni sistem je Uredba (EC) št. 178/2002 [3], ki določa javna načela in zahteve zakona o hrani, ureja Evropski urad za varnost hrane in določa procese za varnost hrane. Namen sistema RASFF je nuditi nadzornemu uradu uspešno orodje za izmenjavo informacij in izvajati ukrepe, ki zagotavljajo varno hrano. Za boljšo preglednost so v nadaljevanju informacije do leta 2004 razdeljene v dve, od leta 2004 naprej pa v tri skupine.

Pravna podlaga za hitri alarmni sistem je Uredba (EC) št. 178/2002 [3], ki določa javna načela in zahteve zakona o hrani, ureja Evropski urad za varnost hrane in določa procese za varnost hrane.

Alarmna obvestila

Alarmna obvestila (*ang. alert notifications*) se pošiljajo, ko hrana predstavlja tveganje na tržišču in ko je potrebno takojšnje ukrepanje. Alarm lahko sproži država članica, ki prva zazna problem in že začne s potrebnimi ukrepi, kot so umik ali zavrnitev blaga. Cilj teh opozoril je dati vsem članom mreže podatke o določenem blagu in jim nuditi možnosti, da ugotovijo ali je določeno blago tudi na njihovem trgu, tako da lahko nato ustrezno ukrepajo. Potrošniki so lahko brez skrbi, da je blago, ki je sprožilo alarmno obvestilo takoj umaknjeno iz prodaje ali pa je v procesu umika. Vsaka od članic ima svoj mehanizem kako se spopasti s težavo, kar tudi vključuje informiranje preko medijev, v kolikor je to potrebno.

Informacijska obvestila

Informacijska obvestila (*ang. information notifications*) se nanašajo na hrano ali krmo, ki predstavlja določeno tveganje, vendar pa niso potrebni takojšnji ukrepi, kajti ta produkt še ni dosegel njihovega trga. V večini se nanašajo na hrano in krmo, ki je bila testirana in nato zavrnjena na zunanji meji Evropske unije. Potrošniki so lahko brez skrbi, kajti nevaren produkt ni dosegel trgovskih polic in potrebni ukrepi so bili že izvedeni. Komisija takšna alarmna in informacijska obvestila tedensko objavi. Ker

Potrošniki so lahko brez skrbi, da je blago, ki je sprožilo alarmno obvestilo takoj umaknjeno iz prodaje ali pa je v procesu umika.

Kadar pride do odkritja resnejših ali ponavljajočih se težav Komisija od pristojnih nacionalnih organov tretje države pisno zahteva izvedbo popravnih ukrepov, kot npr. preprečitev izvoza ali poostritev nadzora.

je potrebno zadeti pravilno razmerje med odkritostjo in varovanjem tržnih informacij, tržnih imen in identitet posameznih podjetij ne objavljajo. Javnost se mora zavedati, da komisija ne more izdati več informacij kot jih javno objavi, čeprav se v izrednih primerih, kjer je za zdravje ljudi potrebno več transparentnosti, lahko zgodi, da komisija te informacije tudi ustrezno posreduje preko običajnih komunikacijskih kanalov. Komisija obvešča oblasti države o poreklu nevarnega blaga, vendar pa to ne pomeni, da nevarnost izhaja iz omenjene države porekla.

Poleg alarmnih in informacijskih obvestil je bila v letu 2004 uvedena nova kategorija prijav o zavrnitvi na meji, ki so bile prej del opozoril. To so uradna obvestila o proizvodih, ki jim je preprečen vstop v EU in jim je dodeljena bodisi nova destinacija ali jih uničijo. Ob odkritju takega proizvoda se preko sistema RASFF z namenom, da preprečijo ponovni pojav, obvesti tretja država iz katere proizvod prihaja. Kadar pride do odkritja resnejših ali ponavljajočih se težav Komisija od pristojnih nacionalnih organov tretje države pisno zahteva izvedbo popravnih ukrepov, kot npr. preprečitev izvoza ali poostritev nadzora.

REZULTATI IN RAZPRAVA

V nadaljevanju so predstavljeni rezultati pregleda objavljenih alarmnih in informacijskih obvestil sistema hitrega obveščanja za živila in krmo. Pri čemer smo upoštevali samo rezultate za skupino “živila”.

Število objavljenih alarmnih in informacijskih obvestil za živila

V letih od 1997 do vključno leto 2008 je bilo skupno objavljenih 43.740 objav v letnih poročilih, od katerih 12,8 % predstavljajo alarmna obvestila, 18,3 % informacijska obvestila, 15,2 % zavrnitve na meji, 30,6 % dodatki k alarmom, 13,3 % dodatki k informacijam in 9,9 % dodatki k zavrnitvam na meji. Čeprav je v letih 1997 – 2007 zaznati izrazit trend porasta v vseh kategorijah obvestil, lahko v letu 2008 moč zaznati rahel upad skupnega števila obvestil in nekoliko občutnejše zmanjšanje števila alarmnih obvestil (Slika 1). Večina (62 %) opozoril v letu 2008 je bila povezana s proizvodi s poreklom iz EU. Večina živil oz. izdelkov pa je bila odkrita med kontrolami na trgu. V tej kategoriji prijav so bili med najpogostejšimi prijavljenimi tveganji, povezanimi z živili ali krmo, potencialno patogeni mikroorganizmi, težke kovine in mikotoksini. V 56 % zavrnitev na meji so bili proizvodi zavrnjeni zaradi previsokih ravni mikotoksinov.

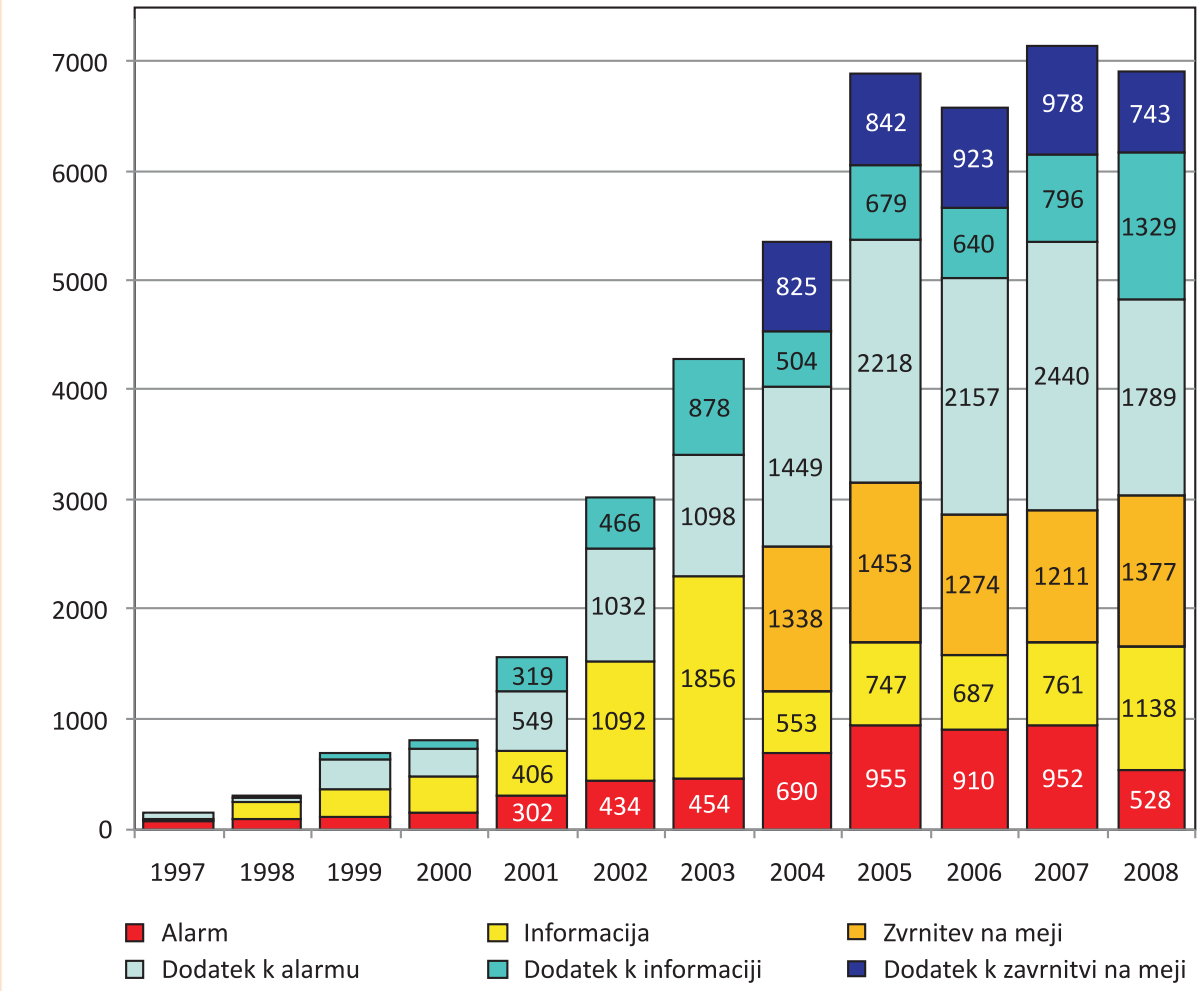
Kljub rahlemu trendu upadanja števila obvestil je v letu 2008 prišlo do nekaterih hujših primerov na področju zagotavljana varne hrane in jih velja izpostaviti. Takšen incident je bilo odkritje mineralnega olja v sončničnem olju iz Ukrajine (prizadetih 39 držav in prejetih 99 obvestil), melamin v hrani iz Kitajske (84 uradnih obvestil RASFF in 101 nadaljnje obvestilo) in odkritje sledov dioksina v svinjini iz Irske (prizadetih 54 držav in prejetih 230 nadaljnjih obvestil) [11].

Kljub rahlemu trendu upadanja števila obvestil je v letu 2008 prišlo do nekaterih hujših primerov na področju zagotavljana varne hrane in jih velja izpostaviti.

Obvestila izločenih/umaknjenih živil glede na skupino izdelkov

Iz objavljenih alarmnih in informacijskih objav RASFF od leta 2002 do vključno leta 2008 je razvidno, da največ objav (20,1 % – 39,9 %) predstavljajo orehi, lešniki in njihovi izdelki; sledijo ribe, raki in mehkužci (21,0 % – 38,5 %), čeprav je pri tej skupini živil mogoče zaznati trend upadanja. Nasprotno predstavljajo žito in pekovski izdelki manjši delež (0,6 % – 26,1%), vendar je pri tej skupini mogoče zaznati trend naraščanja od leta 2002 naprej. Presenetljivo pa jajca in jajčni izdelki, kot predstavniki bolj tvegane skupine običajno hitro pokvarljivih živil predstavljajo minimalni delež (0,5 % – 1,9%) glede na skupno število prijav (Slika 2).

Slika 2:
Število objav vključno z dodatki sistema obveščanja za živila in krmo (RASFF) od 1997 do 2008 [11-17].



Alarmna in informacijska obvestila izločenih oz. umaknjenih živil glede na vrsto tveganja

V letih od 2002 do vključno 2008 je opaziti, da so mikotoksini najpogostejši vzrok izločitve ali umika živil s tržišča, čeprav je opaziti njihov upad. Pri vzrokih, ki so v tabeli 1 označeni z rdečo barvo, je mogoče zaznati trend rasti glede števila prijavljenih primerov, medtem ko je pri vzrokih označenih z zeleno mogoče zaznati trend padanja. V letu 2008 predstavljajo mikotoksini, tako kot vsa leta prej, največji delež (29,7 %),

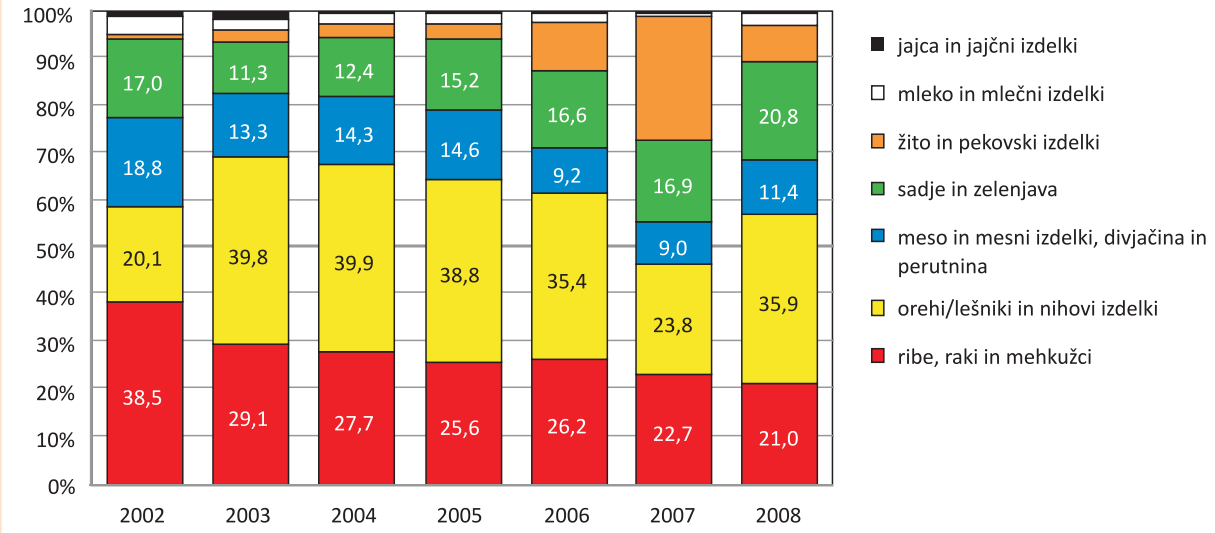
Tabela 1:
Alarmna in informacijska obvestila glede na vrsto povzročiteljev umika/odpoklica živil s tržišča [11-17].

VZROK	Leto						
	2002	2003	2004	2005	2006	2007	2008
Potencialno patogeni mikroorganizmi			19	584	293	396	452
Alergeni						1	48
Ponaredek	1	3	1		1	64	
Alergična reakcija	15	7	9	14	27		
Neučinkovit nadzor				23	34	38	63
Biološka onesnaževala				22	46	51	38
Biološki toksini		6	9	15	38	29	12
Kemijsko onesnaženje	510	400	636	17	31	29	10
Neustrezna sestava				350	137	119	87
Dodatki k krmi			7	3	11	4	18
Prehranski dodatki			11	240	237	219	196
Tujki	14	35	40	77	99	137	145
Gensko spremenjeni organizmi			9	10	151	74	43
Težke kovine		176	96	202	229	266	211
Industrijska onesnaževala				25	73	89	118
Neustrezno označevanje	11	40	20	6	16	23	23
Mikrobiološko onesnaženje	307	478	515	120	54	70	62
Migracije				118	127	115	124
Mikotoksini		805	881	993	874	754	932
Organoleptične lastnosti	2	14	12	32	68	54	63
Poškodbe embalaže	4	9	18	17	19	9	31
Paraziti	19	19	57	22	20	34	38
Ostanki pesticidov	172	64	48	72	94	180	178
Sevanje	3	22	23	32	29	30	30
Ostanki veterinarskih zdravil	446	353	142	167	116	109	107
BSE[1]					7	4	11
Nedoločeno	24	39	59	67	116	99	99
Skupaj	1.528	2.470	2.612	3.228	2.947	2.997	3.139

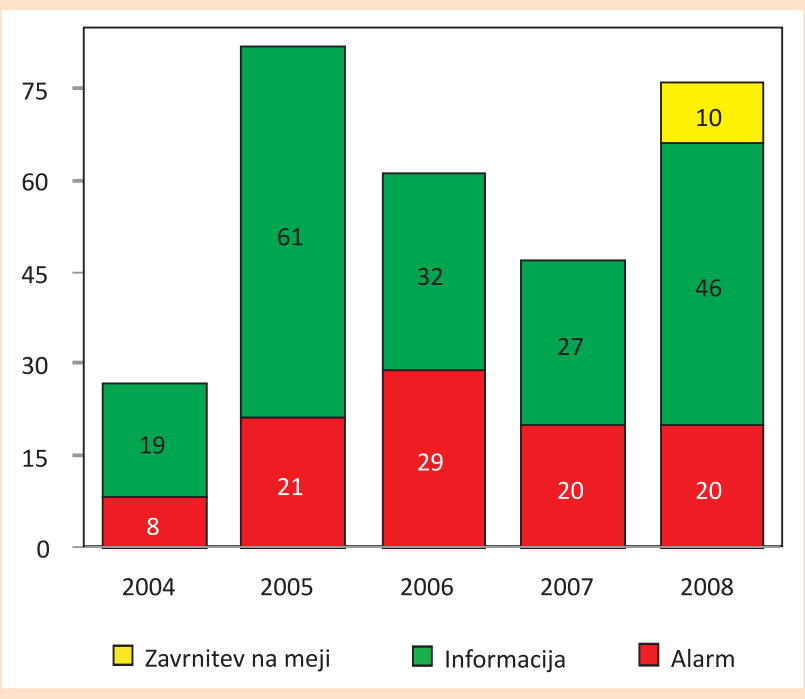
Legenda: Rdeča barva prikazuje naraščajoči, medtem ko zelena padajoči trend.

Opomba: potrebno je upoštevati, da so nekatera obvestila zajemala več vzrokov hkrati in so zato nekateri primeri šteti več kot enkrat.

[1] Goveja ali bovina spongiformna encefalopatija



Slika 3:
Deleži (v %) alarmnih in informacijskih obvestil glede na skupino izdelkov od leta 2002 do 2008 [11-17].



Slika 4:
Število obvestil, ki jih je v letih 2004 do 2008 objavila RASFF Slovenija [11-15].

sledijo potencialno patogeni mikroorganizmi (14,4 %), težke kovine (6,7 %) in prehranski aditivi (6,2 %). Vsi ostali vzroki posamezno predstavljajo manj kot 5 % glede na celotno število prijavljenih primerov v letu 2008. Trend upada mikrobiološkega in kemijskega onesnaženja, bi bila lahko tudi posledica uvedbe predpisov [2,3], ki v državah EU od 1. Januarja 2006 zahtevajo vzpostavitev notranjega nadzora v živilski dejavnosti, ki temelji na osnovnih načelih sistema HACCP.

Obvestila za potrošnike v RS glede tveganih živil na trgu objavlja ZIRS na spletni strani Ministrstva za zdravje (MZ).

Objavljena alarmna in informacijska obvestila za Slovenijo v obdobju 2004 – 2008

Skupno je Slovenija v obdobju od 1.6.2004 do vključno 31.12.2008 objavila 293 alarmnih in informacijskih obvestil v evropskih poročilih RASFF, kar predstavlja 0,9 % vseh obvestil v istem obdobju na evropskem nivoju. Od tega predstavljajo alarmna obvestila 33,5 % in informacijska obvestila 63,1 %. Sklepamo lahko, da je blago, ki je sprožilo alarmno obvestilo, takoj umaknjeno iz prodaje ali je bilo v procesu umika. Skupno število opozoril v EU v letu 2008 je bilo približno enako kot leta 2007 (okoli 7.000), vendar je bilo lani izdanih le 528 pozivov za umik izdelkov iz prodaje, kar je pol manj kot leto poprej in dokaz, da nevarne izdelke v EU prepoznamo hitreje, še preden pridejo na police [4].

Obvestila za potrošnike v RS glede tveganih živil na trgu objavlja ZIRS na spletni strani Ministrstva za zdravje (MZ). Tudi Zveza Potrošnikov Slovenje (ZPS) objavlja novice o zdravstveno neustreznih živilih, vendar ne zajame vseh novic in tudi ne vodi arhiva. Mogoče so obvestila na spletnih straneh Ministrstva za zdravje nekoliko težje dostopna vsem skupinam prebivalstva, vendar običajno, sploh v primeru večjih afer, ki smo jih že omenili, ta obvestila povzamejo tudi drugi mediji, predvsem televizija. Podatki so objavljeni le od leta 2002 dalje, ko je začela veljati Uredba 178/2002 [3], saj prej to področje ni bilo zakonsko urejeno. Iz rezultatov je razbrati, da je v letu 2008 število informacijskih obvestil naraslo v primerjavi z leti 2007 in 2006 medtem ko je število alarmnih obvestil ostalo na enaki ravni.

ZAKLJUČEK

Sistem hitrega obveščanja za živila in krmo je ključno orodje pri naših prizadevanjih za zagotavljanje varnosti hrane v Evropi. RASFF, ki polno izkorišča možnosti komunikacije in sodelovanja, je dejansko eden najuspešnejših primerov celostnega pristopa EU k varnosti hrane.

Ob 30. obletnici delovanja sistema je bila 16. julija v Bruslju organizirana konferenca RASFF z naslovom “Keeping An Eye on Your Food”. Udeleženci konference so govorili o izboljšavah sistema in možnostih širitve delovanja sistema v druge države. EU je že zagotovila sredstva za pripravo podobnega sistema opozarjanja v jugovzhodni Aziji, v drugih državah je organizirala usposabljanja za pomoč pri vzpostavitvi nacionalnih sistemov opozarjanja. Končni cilj vseh prizadevanj je združitev vseh nacionalnih in regionalnih sistemov v svetovno mrežo za obveščanje [4]. Za konec podajamo misel komisarke EU za zdravje Androulle Vassiliou, ki je na omenjeni konferenci izjavila sledeč stavek: “Sistem hitrega obveščanja za živila in krmo je ključno orodje pri naših prizadevanjih za zagotavljanje varnosti hrane v Evropi. RASFF, ki polno izkorišča možnosti komunikacije in sodelovanja, je dejansko eden najuspešnejših primerov celostnega pristopa EU k varnosti hrane” [11].

REFERENCE

[1] Zakon o zdravstveni ustreznosti živil in izdelkov ter snovi, ki prihajajo v stik z živili – ZZUZIS (Ur.l. RS, št. 52/2000 Ur.l. RS, št. 42/2002, 47/2004).

[2] Uredba Evropskega parlamenta in Sveta (ES) št. 852/2004 z dne 29. aprila 2004 o higieni živil.

[3] Uredba (ES) št. 178/2002 Evropskega parlamenta in sveta z dne 28. januarja 2002 o določitvi splošnih načel in zahtevah živilske zakonodaje, ustanovitvi Evropske agencije za varnost hrane in postopkih, ki zadevajo varnost hrane.

[4] Evropska komisija. Nadzor nad hrano za ljudi in živali. 2009: http://ec.europa.eu/news/agriculture/090717_sl.htm (12.08.2009).

[5] Kos Skubic M. Zakonodajni okvir za varno hrano od njive do mize. Ministrstvo za kmetijstvo, gozdarstvo in prehrano, Ljubljana. 2006: http://www.sist.si/slo/z2/0602-zakonodajni.pdf (18. 4. 2007).

[6] Uredba (ES) št. 853/2004 Evropskega parlamenta in Sveta z dne 29. aprila 2004 o posebnih higienskih pravilih za živila živalskega izvora.

[7] Uredba (ES) ŠT. 882/2004 Evropskega parlamenta in sveta z dne 29. aprila 2004 o zvajanju uradnega nadzora, da se zagotovi preverjanje skladnosti z zakonodajo o krmi in živilih ter s pravili o zdravstvenem varstvu živali in zaščiti živai.

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Priporočila Evropske agencije za varno hrano glede zbiranja podatkov o uživanju hrane

Matej **GREGORIČ**[1*], Irena **DOBRILA**[1], Ana **VEBER**[1]

UVOD

Po številnih krizah v živilskem sektorju konec devetdesetih let prejšnjega stoletja se Evropska Komisija znova trudi pridobiti zaupanje potrošnikov in zaščititi javno zdravje. EU je s svojim pristopom reševanja problema začrtala novo pot oz. nov pristop v smeri zaščite zdravja potrošnika. Zaradi globalizacije je prišlo do pestrejše ponudbe živil na trgu, hkrati pa se je okrepila tudi zavest potrošnikov, kar je vodilo k širjenju zahtev po večji varnosti, kvaliteti ter prehranski vrednosti živilskih proizvodov. Obstoječi sistem, ki je zagotavljal varnost hrane, se je moderniziral v smislu ustanovitve *Evropske agencije za varnost hrane* (v nadaljevanju EFSA). Ustanovljena je bila leta 2002 kot neodvisni znanstveni vir svetovanja in obvestil o tveganjih, povezanih z živilsko verigo. Agencija je bila oblikovana kot del celovitega programa za izboljšanje varnosti živil v Evropski zvezi, zagotavljanja visoke ravni varstva potrošnikov ter ponovne vzpostavitve in ohranitev zaupanja v oskrbo s hrano. Njeno osnovno **poslanstvo je zagotavljanje varne hrane v Evropi.** Za učinkovito obvladovanje obsežnega področja varnosti živil je bistveno dobro sodelovanje, zato je EFSA sprejela strategijo sodelovanja med državami članicami in agencijo. Naloga EFSA je tudi podajanje objektivnih in neodvisnih strokovnih nasvetov državam članicam, ki so osnovani na najnovejših znanstvenih dognanjih in razpoložljivih podatkih. EFSA ima kot strokovno telo številne naloge na različnih področjih, tako med drugim obravnava tudi aditive v hrani in krmi, alergene, zdravje živali in rastlin, zaščito živali, gensko spremenjene organizme (GMOs) in pesticide (MRLs). Prav tako se postopki izdelave ocen tveganj pri zagotavljanju varne hrane zaradi centralizacije z nacionalnih prenašajo na evropsko raven. Za vrednotenje takšnih tveganj je poleg podatkov o prisotnosti določenih onesnaževal v hrani nujno potreben tudi zanesljiv podatek o vzorcih uživanja hrane pri različnih skupinah populacije. Za kvantificiranje te izpostavljenosti pa so nujno potrebni čim bolj natančni in zanesljivi podatki o količini in vrsti zaužite hrane. Zaradi pomanjkljivosti državnih rutinskih podatkov ter potreb po zanesljivejših in medsebojno primerljivih podatkih je EFSA pričela s pripravo priporočil glede izvajanja nacionalnih prehranskih raziskav. Zaradi različnih metod

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zbiranja podatkov o uživanju hrane ter različnih vzorcev prehranjevanja (visoke razlike v uživanju sadja in zelenjave, stročnic, masla, rastlinskega olja ipd.) v posameznih državah članicah je EFSA prevzela vlogo koordinatorke zbiranja in harmonizacije trenutno razpoložljivih nacionalnih podatkov.

METODE ZBIRANJA PODATKOV

Večina metod, ki jih uporabljajo države članice za zbiranje podatkov o uživanju hrane, daje bolj ali manj mednarodno primerljive podatke. Poleg tega ima vsaka od metod svoje prednosti in omejitve [2]. Pri EFSA je bila zato ustanovljena posebna strokovna skupina, ki je na podlagi zbranih informacij in izsledkov evropskih raziskav (EFCOSUM; EPIC; EFCOVAL; FACET; DAFNE ipd.) postavila nova merila, ki jih morajo države članice izpolnjevati glede izvajanja raziskav in postopkov zbiranja podatkov o uživanju hrane. Pri tem skupina ugotavlja, da obstajajo številne metode, s katerimi lahko bolj ali manj natančno ocenimo dejansko količino in vrsto užitih živil preiskovane populacije. Nekatere rutinske podatke države članice zbirajo s posrednimi metodami, ki so lahko uporabne le za oceno razpoložljivosti hrane v populaciji ali za proučevanje prehrane v družini (gospodinjstvih) oziroma drugih institucionalnih oblikah prehrane. Prednost teh metod je, da so cenejše in manj zahtevne od neposrednih metod. Primerne so za proučevanje prehranskih navad populacije in ugotavljanje trendov, primerjamo pa lahko tudi prehranske navade populacije iz različnih geografskih in kulturnih okolij ter glede na njihov različni socio-ekonomski položaj. Podatkov o količinah in kakovosti dejansko zaužite hrane na nivoju posameznika pa zaradi kompleksnosti postopkov izbire živil in načina prehranjevanja preprosto s temi metodami ni mogoče zagotoviti. Pomanjkljivost teh metod so tudi različne sistematične in slučajne napake, vendar se zaradi smotrnosti pogosto zadovoljimo prav z informacijami o povprečni porabi oziroma razpoložljivosti živil [4,5].

Večina metod, ki jih uporabljajo države članice za zbiranje podatkov o uživanju hrane, daje bolj ali manj mednarodno primerljive podatke.

Večina držav članic za potrebe natančnejših in podrobnejših analiz uživanja hrane izvaja tudi občasne raziskave z bolj natančnimi neposrednimi metodami dela. Te so primerne za ocenjevanje izpostavljenosti različnim fizikalnim, kemičnim biološkim onesnaževalom v hrani ter za oceno energijske vrednosti in vsebnosti hranil zaužitih obrokov. Te metode temeljijo na individualnem anketiranju oziroma različnih meritvah in omogočajo [1,2]:

- pridobitev podatkov o vseh živilih, ki jih je posameznik zaužil;
- dovolj natančno identifikacijo zaužitih živil, ki jim lahko določimo ustrezno živilo v prehranskih tabelah;
- dovolj natančno določanje velikosti posameznih porcij za vsako zaužito živilo (lahko temelji na standardiziranih prikazih živil);
- izračun vsebnosti hranil zaužitega obroka s prehranskimi preglednicami;
- določanje pogostosti uživanja posameznega živila ter
- pri natančnejših raziskavah pa tudi kemijsko analizo preučevanega obroka, na podlagi katere je možno določiti vsebnost hranil v obroku.

Podatkov o količinah in kakovosti dejansko zaužite hrane na nivoju posameznika pa zaradi kompleksnosti postopkov izbire živil in načina prehranjevanja preprosto s temi metodami ni mogoče zagotoviti.

Izpostavljenost določenim kemičnim ali biološkim onesnaževalom se ugotavlja za tisti del populacije, ki zaužije večje količine živil, ki so obremenjene z iskanim onesnaževalom.

STANDARDIZACIJA POSTOPKOV ZBIRANJA PODATKOV

Za ocene izpostavljenosti določenim onesnaževalom v živilih niso dovolj podatki o povprečnih količinah zaužitih živil na individualni ravni, temveč dovolj statistično zanesljivi podatki za oceno izpostavljenosti najvišjim vnosom. Izpostavljenost določenim kemičnim ali biološkim onesnaževalom se ugotavlja za tisti del populacije, ki zaužije večje količine živil, ki so obremenjene z iskanim onesnaževalom. Prav tako se lahko obravnava izpostavljenost posebej bolj dovzetnih (ranljivih) skupin ter tistih s posebnimi prehranskimi navadami (npr. vegetarijancev), zdravstvenimi težavami (npr. diabetikiov), iz različnih etničnih skupin ipd. [4,5]. Natančnost ocen za te najbolj izpostavljene skupine pa je odvisna tudi od zadostnega števila preiskovancev v raziskavi.

Poleg tega priporočajo uporabo takšnih metod, ki zagotavljajo čim večjo natančnost in zanesljivost podatkov ter čim manjšo možnost napak. Zaradi uporabe različnih metodologij in različnih sistemov klasifikacije živil med državami članicami podatki o vrsti in količini zaužitih živil pogosto niso povsem primerljivi. Na zanesljivost podatkov pa lahko vplivajo tudi razlike v številu dni anketiranja, nivoju razvrščanja živil in v natančnosti podatkov sestavljenih jedi. Zaradi uporabe različnih metod in pristopov k izvajanju takšnih raziskav je standardizacija postopkov na nivoju Evropske skupnosti postal prioritetni in ključni cilj EFSA. Harmonizirani podatki o uživanju hrane so prepoznani kot nujni za delovanje številnih evropskih institucij, drugih organov in deležnikov. Tako pridobljeni podatki so pomemben vir informacij pri:

Zaradi uporabe različnih metod in pristopov k izvajanju takšnih raziskav je standardizacija postopkov na nivoju Evropske skupnosti postal prioritetni in ključni cilj EFSA.

- spremljanju in zagotavljanju varnosti živil;
- spremljanju prehranskih navad;
- načrtovanju prehranske politike;
- živilski zakonodaji in varstvu potrošnikov,
- izvajanju epidemioloških študij,
- načrtovanju razvoja kmetijstva in živilsko predelovalne industrije;
- razvoju živilskih izdelkov;
- izobraževanju in znanosti;
- razvoju trgovine, marketinga in logistike;
- načrtovanju preventivnega zdravstvenega varstva itd.

VLOGA EVROPSKE AGENCIJE ZA VARNO HRANO

EFSA je že v preteklosti opredelila minimalne pogoje, pod katerimi lahko države članice posredujejo podatke v skupno podatkovno bazo. Podatki o uživanju hrane morajo biti zadnje dostopni, nacionalno reprezentativni in zbrani po metodi na individualnem nivoju. Zaradi potrebne natančnosti je zahtevan čim bolj podroben nivo poročanih podatkov in čim bolj podrobne informacije v zvezi s potekom raziskave in uporabljenih metodah ter orodjih. Kot najprimernejši metodi, ki sta primerni predvsem za raziskave na odraslih preiskovancih, sta metoda jedilnika preteklega dne ali metoda beleženja ocenjene količine obroka. Ob tem preverjamo uporabo pristopov, ki povečajo zanesljivost vrednotenja

zaužitih količin (npr. prikaze standardnih velikosti porcij, modele standardnih obrokov, programska orodja). Z vidika ocen tveganja zbiramo tudi spremljajoče podatke kot npr. podatke o načinu priprave hrane in načinih pakiranja živil.

Trenutna baza podatkov, s katero razpolaga EFSA, obsega podatke za 15 glavnih skupin živil in za 29 podskupin. Naloga ustanovljene skupine pri EFSA je, da dopolni obstoječo bazo podatkov z bolj natančnimi, tudi glede živil, ki se uživajo v zelo majhnih količinah in/ali zelo redko. Tudi v bodoče bodo potekali projekti, s katerimi bomo proučevali različne možnosti za povečanje zanesljivosti podatkov in zmanjšanje napak pri vrednotenju zaužitih količin živil. Posebno pozornost bo namenjena zbiranju podatkov za ranljive skupine, kot so npr. otroci, starostniki in nosečnice. Trenutne ocene za dojenčke in majhne otroke so nezanesljve, saj temeljijo na pomanjkljivih podatkih. Posebej ranljiva skupina so tudi starejši, še zlasti ko gre za biološka onesnaževala, saj je pri njih zaradi oslabljenega imunskega odziva večja možnost alimentarnih okužb. Slednji dve skupini sta tudi posebej zahtevni glede izbire primerne metode zbiranja podatkov in težje dostopnosti (institucionaliziranost, zdravstvene težave…).

Posebno pozornost bo namenjena zbiranju podatkov za ranljive skupine, kot so npr. otroci, starostniki in nosečnice.

ZAKLJUČEK

Oskrba z varno hrano, ki ne ogroža zdravja potrošnikov zaradi fizikalnih, kemičnih, bioloških ali drugih vrst onesnaževal je temelj zdrave prehrane in pomemben dejavnik varovanja zdravja kot javnega interesa. Dolgoročni cilj EFSA je zagotoviti varnost v celotni prehrambeni verigi na osnovi zanesljivih ocen izpostavljenosti. Mandat strokovne skupine pri EFSA za področje podatkov o uživanju hrane je tako priprava in uveljavitev standardiziranega postopka zbiranja podatkov na nivoju držav članic EU, kar bo povečalo mednarodno primerljivost podatkov. Redno dopolnjevana baza medsebojno primerljivih podatkov o vrsti in količini zaužitih živil bo osnova za zanesljive ocene izpostavljenosti in posledičnega vrednotenja tveganja ter hitro ukrepanje med državami članicami.

Oskrba z varno hrano, ki ne ogroža zdravja potrošnikov zaradi fizikalnih, kemičnih, bioloških ali drugih vrst onesnaževal je temelj zdrave prehrane in pomemben dejavnik varovanja zdravja kot javnega interesa.

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