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## Interview with Dr. Arnaud Maxime Cheumani Yona

### Intervju - dr. Arnaud Maxime Cheumani Yona

Katarina Čufar

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Dr. Arnaud Maxime Cheumani Yona\* worked at our Department of Wood Science and Technology (DWST), Biotechnical Faculty (BF), University of Ljubljana (UL) from 1st February 2020 to 31st July 2021. In September 2018, he applied for Marie Skłodowska Curie (MSC) European Individual Fellowship with the proposal "SilWoodCoat". The project was awarded the seal of excellence in March 2019 and in September 2019 the Slovenian National Research Agency (ARRS) supported the fellowship so that research work could be conducted in Ljubljana, Slovenia. We have interviewed Dr. Arnaud Maxime Cheumani Yona in November 2021.



Figure 1. Dr. Arnaud Maxime Cheumani Yona in the office at the Department of Wood Science and Technology, Biotechnical Faculty, University of Ljubljana, Slovenia.

Slika 1. Dr. Arnaud Maxime Cheumani Yona v pisarni na Oddelku za lesarstvo Biotehniške fakultete, Univerze v Ljubljani.

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**1. Dr. Arnaud Maxime Cheumani Yona, can you please briefly present yourself and your professional development?**

I hold a PhD in physical sciences and engineering, speciality Wood Science, completed in 2009 at Bordeaux 1 University in France with the support of the international French-speaking university network AUF, "Agence Universitaire de la Francophonie". I am a chemist by training. I have a Bachelor of Science in chemistry and a master's degree in physical chemistry. I teach chemistry at the Faculty of Science of the University of Yaounde 1 in Yaounde, Cameroon, and since 2012 I perform my research activities in the macromolecular team in the Laboratory of Applied Inorganic Chemistry. I have supervised a dozen master's theses. Currently I am involved in the supervision of five PhDs, three of the five jointly with research groups in France, Belgium, and India. I have expertise in wood coatings, the preparation and characterization of composite materials from wood and other lignocellulosic residues, organic, and inorganic polymers, and biopolymers' extraction and characterization.

**2. What is your current position at your home university?**

I've been a senior lecturer at my home University of Yaounde 1 since 2013. It is the second grade in our university hierarchy. The first is assistant professor, and above there are associate professor and the highest full professor.

**3. What stimulated your co-operation with Prof. Dr. Marko Petrič and University of Ljubljana?**

Prof. Dr. Petrič and I met in France in 2010 after the defence of my PhD doctorate. He was an invited researcher in the laboratory of Prof. Dr. Philippe Girardin at the University of Nancy-France, which was one of the reviewers of my PhD thesis. I can say that at that time I had poor knowledge of Central European countries and Slovenia. But we discussed research opportunities at UL and living in Slovenia. His scientific knowledge, general skills and expertise, and human qualities convinced me, so I joined the UL in 2011 for a post-doctoral position in collaboration with the former Institute of Wood Science of Technology. The research stay was successful and led to several research articles in peer-reviewed journals and conferences papers. We remained in contact since that period looking for research collaboration opportunities, and I'm happy to be here at BF-UL working on this new research project.

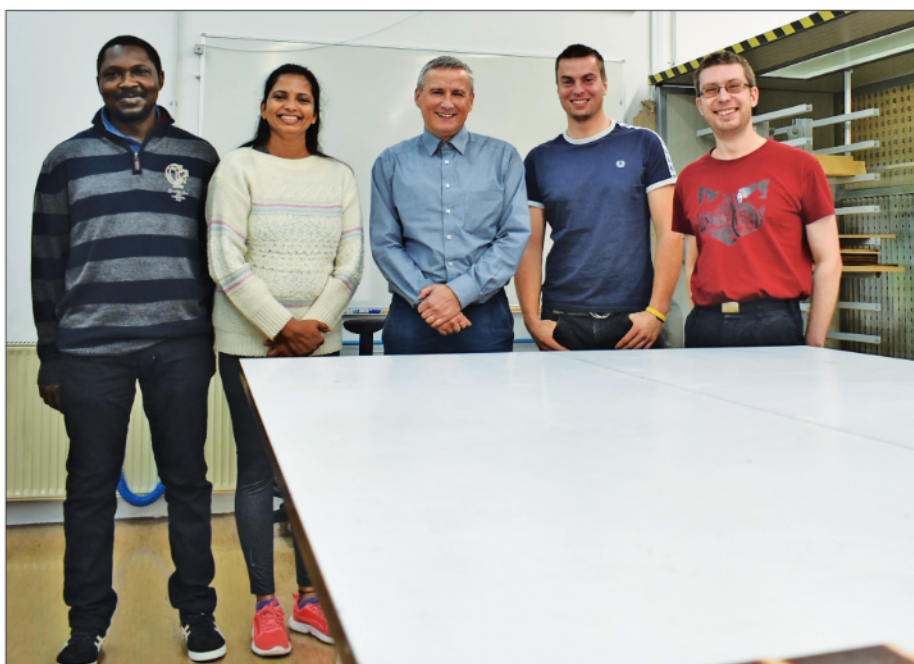


Figure 2. Group members with the supervisor; from left to right Arnaud Maxime Cheumani Yona, Kavyashree Srinivasa, Marko Petrič, Jure Žigon and Sebastian Dahle in spring of 2021.

Slika 2. Skupina raziskovalcev z mentorjem prof. dr. Markom Petričem, od leve proti desni Arnaud Maxime Cheumani Yona, Kavyashree Srinivasa, Marko Petrič, Jure Žigon in Sebastian Dahle spomladi 2021.

**4. Which program supported your stay in Ljubljana in the recent period?**

We applied for the Marie Skłodowska Curie (MSC) European Individual Fellowship with the proposal "SilWoodCoat". The project was awarded the seal of excellence, but the available funds were not enough for the financial support of the project at the European level. As it is common in many European countries to fund MSC seal of excellence projects through the national research agency, our project is supported by ARRS, the Slovenian Research Agency.

**5. What are the main challenges and achievements of your stay?**

The objective of the project is the development of mineral silicate-based coatings that could perform durably on wood without primer. The binder for such coatings is a water glass (especially potassium) or a silicate sol (mixture of water glass and colloidal silica). Silicate coatings have been used for concrete and masonry, and the corrosion protection of steel, and have proved to be able to provide UV light and biological resistance, fire resistance, and durable finishes at the surface of these materials. Wood is a material with different structures and chemistries, and is dimensionally less stable than con-

crete and steel. It undergoes significant swelling and shrinkage when exposed to moisture which leads to important mechanical stresses on the coating layers and results in progressive cracking and debonding of the coatings. The durability of a coating at the surface of wood depends on its ability to prevent moisture uptake or to accommodate the ensuing mechanical stresses, and to protect wood against other damaging agents (UV light, fungi, and insects). This ability can be estimated through measurements of the coating's properties, such as adhesion strength, flexibility, scratch and impact resistances, and water resistance. However, the literature on the performances of silicate coatings on wood substrates remains limited. A technology using a mineralized primer based on an alkyd resin or drying oil and silicate coatings as a top layer has been developed by some companies, such as Keimfarben® and Beeck®. A coating without a primer or with a low-cost water-based primer could reduce the cost of the protection. We have formulated silicate coatings with different mass ratios between the components and chemical additives to study their adhesion, surface morphology, and water resistance at the surface of the wood. This work has led to the publication of two research arti-

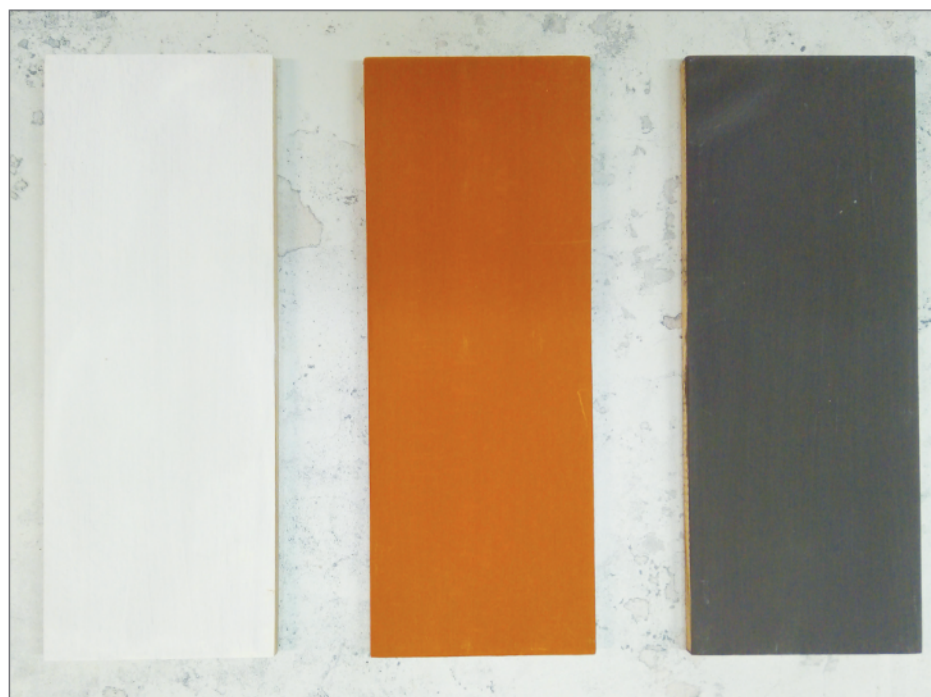


Figure 3. Beech wood samples coated with silicate coatings containing different mineral pigments. From left to right white (titanium dioxide), brown (iron(III) oxide) and deep blue (copper (II) oxide).

*Slika 3. Vzorci bukovega lesa, prevlečeni s silikatnimi premazi, ki vsebujejo različne mineralne pigmente. Od leve proti desni bela (titanov dioksid), rjava (železov(III) oksid) in temno modra (bakrov(II) oksid).*

cles in peer reviewed journals. A review article was also prepared and published in the *Journal of Wood Science and Technology*.

**6. What are the main professional challenges of your home university and country, and in global sense?**

In Cameroon, with an area of 475,442 km<sup>2</sup> and 24 million inhabitants, the forest covers approx. 22 million hectares, i.e., 46% of the total land area. The wood production is estimated around 2.3 million m<sup>3</sup> per year and the forestry sector represents 30% of the national economy, with a contribution between 2 and 4% to GDP. This contribution can be increased by a reduction of unprocessed and semi-processed log exports, production of value-added timbers and reconstituted wood fibre or particle composites. Indeed, wood exploitation provides a significant volume of residues, including upper parts of the trunk and branches (about 40% of the cut trees), and the residues from the first and second transformations. These residues are currently partially used for mainly domestic heating, but a great part is abandoned and non-valorized. Moreover, Cameroon has approximately three hundred (300) tree species, but only about twenty are commercialized. Fortunately, there is a growing awareness at the national level of the need to strengthen the technical know-how and solutions in the wood industry through appropriate training programmes in wood timber construction, wood fibres or particle boards and valorization of wood in biorefining processes. The University Institute of Wood Technology Mbalmayo, almost entirely focused on wood technology, has recently been opened at the University of Yaounde 1, in addition to other wood training program at the University of Dschang in Dschang, West Cameroon, and the University of Douala, Douala, in the coastal region of Cameroon. I am collaborating with these institutes for the training of students, and several of them have already had a research stay in our laboratory. I think if we believe in our potential, we can rapidly gain expertise in the field of wood timber and reconstituted wood panels for construction and furniture.

Dr. Arnaud Maxime Cheumani Yona je od 1. februarja 2020 do 31. julija 2021 delal na Oddelku za lesarstvo (OL) Biotehniške fakultete (BF) Univerze v Ljubljani (UL). Septembra 2018 se je s predlogom projekta "SilWoodCoat" prijavil za evropsko individualno štipendijo Marie Skłodowska Curie (MSC). Projekt je marca 2019 prejel znak odličnosti, Javna agencija za raziskovalno dejavnost Republike Slovenije (ARRS) pa ga je septembra 2019 podprla s štipendijo za izvajanje raziskovalnega dela v Ljubljani. Razgovor z njim smo opravili novembra 2021.

**1. Dr. Arnaud Maxime Cheumani Yona, ali lahko na kratko predstavite sebe in svoj poklicni razvoj?**

Imam doktorat iz fizikalnih znanosti in tehnike, specialnost Lesarstvo, ki sem ga zaključil leta 2009 na Univerzi Bordeaux 1 v Franciji s podporo mednarodne francosko govoreče univerzitetne mreže AUF "Agence Universitaire de la Francophonie". Po izobrazbi sem kemik. Imam diplomo iz kemije in magisterij iz fizikalne kemije. Od leta 2012 poučujem kemijo na Fakulteti za naravoslovje Univerze Yaounde 1, raziskovalno dejavnost pa opravljam v makromolekularni skupini v Laboratoriju za uporabno anorgansko kemijo. Vodil sem vrsto magistrskih nalog. Sodelujem kot mentor ali somentor pri petih doktorandih, od tega pri treh sodelujem z raziskovalnimi skupinami v Franciji, Belgiji in Indiji. Imam strokovno znanje na področju premazov za les, priprave in karakterizacije kompozitnih materialov iz lesa in drugih lignoceluloznih ostankov, organskih in anorganskih polimerov ter ekstrakcije in karakterizacije biopolimerov.

Od leta 2013 sem višji predavatelj na domači univerzi. S prof. dr. Petričem sva se srečala v Franciji leta 2010 po zagovoru mojega doktorata. Bil je vabljeni raziskovalec v laboratoriju prof. dr. Philippa Girardina na Univerzi v Nancy-Franciji in je bil eden od recenzentov moje doktorske disertacije. Lahko rečem, da sem takrat slabo poznal srednjeevropske države in Slovenijo. Razpravljali pa smo o raziskovalnih možnostih na UL in bivanju v Sloveniji. Njegovo znanstveno delo, splošne veščine in strokovnost ter človeške lastnosti so me prepričali, da sem se leta 2011 pridružil UL na podoktorskem projektu v sodelovanju s takratnim Tehnološkim inštitutom za lesarstvo. Raziskovalno bivanje je bilo uspešno

in je privedlo do številnih znanstvenih člankov v strokovnih revijah. Pripravili smo tudi prispevke na konferencah. Od takrat ostajamo v stiku in iščemo priložnosti za raziskovalno sodelovanje. Vesel sem, da lahko delujem na BF-UL na raziskovalnem projektu.

V letu 2018 sem se prijavil za evropsko individualno štipendijo Marie Skłodowska Curie (MSC) s projektom »SilWoodCoat«. Projekt je prejel pečat odličnosti, a razpoložljiva sredstva niso zadostovala za finančno podporo projekta na evropski ravni. Kot je v mnogih evropskih državah običajno, da financirajo projekte s pečatom odličnosti MSC prek nacionalne raziskovalne agencije, je tudi naš projekt podprla ARRS.

Cilj projekta je razvoj premazov na osnovi mineralnih silikatov, ki bi se dobro obnesli brez temeljnega premaza. Vezivo za takšne premaze je vodno steklo (zlasti kalijevo) ali silikatna sol (mešanica vodnega stekla in koloidnega silicijevega dioksida). Silikatne premaze uporabljajo za beton in zidove, protikorozijsko zaščito jekla. Lahko zagotovijo zaščito pred ultravijolično svetlobo in povečajo biološko odpornost, požarno odpornost in so zelo trajni. Les je material s posebno zgradbo in kemizmom, ter je dimenzijsko manj stabilen od betona in jekla. Ko je izpostavljen vlagi, je podvržen znatnemu nabrekanju in krčenju, kar vodi do pomembnih mehanskih obremenitev na slojih premaza in povzroči postopen nastanek razpok in ločevanje premazov od podlage. Obstojnost premaza na površini lesa je odvisna od njegove sposobnosti preprečevanja vdora vlage ali prilagajanja posledičnim mehanskim obremenitvam ter zaščite lesa pred drugimi škodljivimi vplivi (ultravijolična svetloba, glive in insekti). To sposobnost je mogoče oceniti z meritvami lastnosti premaza, kot so oprijemna trdnost, fleksibilnost, odpornost proti razenju in udarcem ter vodoodpornost. Literatura o delovanju silikatnih premazov na lesnih podlagah je bila doslej redka. Nekatera podjetja, kot sta Keimfarben® in Beeck®, so razvila tehnologijo z uporabo mineraliziranega temeljnega premaza na osnovi alkidne smole ali sušečega se olja in silikatnih premazov kot zgornje plasti. Premaz brez temelja ali z nizkocenovnim temeljnim premazom na vodni osnovi bi lahko znižal stroške zaščite. Zasnova-

li smo silikatne premaze z različnimi masnimi razmerji med komponentami in kemičnimi dodatki, da bi preučili njihovo oprijemnost, morfologijo površine ter vodoodpornost na površini lesa. Raziskave so privedle do objave dveh člankov v znanstvenih revijah. Objavili smo tudi pregledni članek, ki je bil objavljen v Journal of Wood Science and Technology.

## 2. Kateri so vaši glavni raziskovalni izzivi?

V Kamerunu s površino 475 442 km<sup>2</sup> in 24 milijoni prebivalcev gozd pokriva pribl. 22 milijonov hektarjev, to je 46 % celotne površine. Proizvodnja lesa je ocenjena na okoli 2,3 milijona m<sup>3</sup> na leto, gozdarski sektor pa predstavlja 30 % nacionalnega gospodarstva s prispevkom med 2 do 4 % k bruto domačemu proizvodu (BDP). Prispevek lesnega sektorja k BDP bi se lahko povečal z zmanjšanjem izvoza nepredelane in delno predelane hlodovine. Povečati bi morali predelavo lesa v izdelke z visoko dodano vrednostjo in s proizvodnjo lesnih vlaken ali kompozitov. Izkoriščanje lesa zagotavlja pomembno količino ostankov, vključno z zgornjim delom debla in vejami (približno 40 % volumna posekanih dreves), nastajajo tudi ostanki iz primarne in sekundarne predelave. Ostanki se trenutno delno uporabljajo predvsem za ogrevanje gospodinjstev, velik del pa ostane neizkoriščen. Poleg tega ima Kamerun približno tristo (300) različnih drevesnih vrst, približno dvajset pa jih ima komercialni pomen. Na srečo se na nacionalni ravni krepi zavedanje o potrebi po krepitvi tehničnega znanja in rešitev v lesni industriji z ustreznimi izobraževalnimi programi na področju lesene gradnje, lesnih vlaken ali ivernih plošč in uporabe lesa v biorafinerijah. Univerzitetni inštitut za tehnologijo lesa Mbalmayo, ki je skoraj v celoti osredotočen na lesnopredelovalno tehnologijo, je bil nedavno ustanovljen na Univerzi Yaounde 1, poleg drugih obstoječih programov usposabljanja za les na Univerzi Dschang in Univerzi v Douali. S temi inštituti sodelujem pri usposabljanju študentov in nekaj jih je že zaključilo raziskovalno delo v našem laboratoriju. Mislim, da lahko, če verjamemo v svoje potenciale, hitro pridobimo strokovno znanje na področju masivnega lesa in lesnih plošč za gradbeništvo in pohištvo. ●