Kratek opis usposabljanja mladega raziskovalca (*Short description of the Young Researcher's training)*

1. Raziskovalna organizacija (*Research organisation)*:

Univerza v Ljubljani, Biotehniška fakulteta University of Ljubljana, Biotechnical Faculty

2. Ime, priimek in elektronski naslov mentorja (*Mentor's name, surname and email*):

Miha Humar miha.humar@bf.uni-lj.si

3. Šifra in naziv raziskovalnega področja (*Research field*):

4.01 Gozdarstvo, lesarstvo in papirništvo

4. Kratek opis usposabljanja mladega raziskovalca (*Short description of the Young Researcher's training)*:

Navedite tudi morebitne druge zahteve, vezane na usposabljanje mladega raziskovalca (npr. znanje angleškega jezika, izkušnje z laboratorijskim delom, potrebne licence za usposabljanje…).

slo:

Izhodišče

Materiali na osnovi lesa so obnovljivi, CO2 nevtralni viri. Zato jih uvrščamo med okolju prijazne materiale. Raznolike lesne vrste in kompoziti omogočajo široko paleto ustvarjalnih in estetskih alternative materialom z večjimi okoljskimi vplivi, tako med proizvodnjo kot tudi med uporabo in odstranjevanjem. Moderna gradbena praksa ne bi bila mogoče brez uporabe lesa in še posebej lesnih kompozitov. To omogočajo tudi izvedeni kompozitni poizvodi, izdelani iz vlaken, furnirja spojeno z lepili ali podobnimi rešitvami. Ta pristop omogoča uporabo lesa slabše kvalitete za proizvodnjo materialov s prilagojenimi lastnostmi za specifične, ciljne aplikacije. V življenjski dobi so stavbe in gradbeni elementi izpostavljeni številnim okoljskim vplivom, ki delujejo na les. Za materiale na osnovi lesa, so nihajoča vlažnost in biološki dejavniki, kot so plesni, glive modrivke in razkrojevalke pogosto kritičen, zlasti pri aplikacijah kot so fasadne obloge in terase v zunanjih pogojih uporabe. Napovedovanje življenjske dobe, analiza celotnih stroškov objekta, in estetika novih gradbenih materialov na biološki osnovi so bistvenega pomena za njihovo promocijo in večjo uporabo v gradbenem sektorju. Žal večina evropskih lesenih vrst nima naravno odpornega lesa. Zaščitni ukrepi so zato neizogibni pri uporabi na prostem, kjer je les izpostavljen vremenskim vplivom ali je celo v stiku s tlemi. Te tehnike vključujejo: uporabo biocidov, vodoodbojnih sredstev, površinskih premazov, konstrukcijsko zaščito, razvoj nove generacije kompozitov … Odpornost lesa na različne dejavnike staranja je vedno kombiniran učinek toksičnih ali inhibitornih sestavin na eni strani in strukturnih, anatomskih ali kemičnih načinov hidrofobnosti, ki je eden najpomembnejših dejavnikov. Zato je treba posebno pozornost nameniti izboljšanju odpornosti proti navlaževanju lesa s premazi in drugimi hidrofobnimi sredstvi. Videz gradbenih materialov na biološki osnovi se spreminja med njihovo življenjsko dobo. Zato je estetska življenjska doba pogosto odločilen kriterij za te aplikacije, kar je treba upoštevati.

Cilji;

Odpornost lesa je eden najpomembnejših dejavnikov za izbiro lesa za rabo na prostem. Razvrščanje lesa temelji na izgubi mase po razkroju in / ali razkroju po izpostavitvi v stiku z zemljo (EN 252. Vendar nedavne študije kažejo, da je življenjska doba lesa na prostem vedno kombiniran učinek toksičnih ali inhibitornih sestavin na eni strani ter strukturnih, anatomskih ali kemičnih načinov izključitve vlage (odpornost proti navlaževanju). Zato bomo določili odmerek DRd kot produkt kritičnega odmerka Dcrit in dveh dejavnikov, ki upoštevata odpornost lesa proti navlaževanju (kwa) in njegovo naravno odpornost (kinh).

Podatke, pridobljene z laboratorijskimi preiskavami, bomo primerjali z obnašanjem lesa na terenskih poskusih.

Raziskovalna skupina je vzpostavila testna območja na štirih lokacijah v Sloveniji (Ljubljana, Ig, Bilje, Koper), kar omogoča primerjavo klimatskih pogojev na izpostavljen les na prostem. Izpostavljenih je že več kot 3000 vzorcev, ki bodo redno spremljani in ocenjevani. Poseben poudarek bo namenjen oceni delovanja lesnih kompozitov pri zunanji uporabi, kjer bodo redno ocenjene naslednji parametri: razrkoj, sprememba barve, razpoke, mehanske lastnosti … ter lastnosti lepilnih spojev v kompozitih, izpostavljenih v zunanjih pogojih. Vlažnost lesa v lesu med izpostavljenostjo na prostem bo stalno spremljana in povezana z razkrojem in ostalimi parametri.
Pomen estetske vrednosti lesa narašča in barva je eden najpomembnejših parametrov estetike, zato bo barvna stabilnost več lesnih materialov ocenjena z več laboratorijskimi testi. Sprememba barve lesa pri zunanji uporabi so že dolgo znani pojav, ki je posledica različnih biotskih in abiotskih vzrokov. V okviru PS že dolgo spremljamo barvo lesa na modelnem objektu, to izvajamo od oktobra 2013, zato je na voljo dolga časovna serija sprememb barv, ki omogoča podrobno primerjavo laboratorijskih in terenskih podatkov. Te časovne vrste so primerne za modeliranje in napovedovanje sprememb barv ter vključitev v programsko opremo za informacijsko modeliranje stavb (BIM), kar bo kupcem lesenih stavb olajšalo nakupno odločanje.

Izobrazba in izkušnje
Izobrazba biotehniške, naravoslovne ali tehniške smeri
Izkušnje pri delu v laboratoriju z analitsko opremo na področju delovanja skupine so dobrodošle.

Prednost imajo diplomanti z izkušnjami z obdelavami velikih količin podatkov, zahteva (bo zahtevalo) dobro znanje Excela, programov za statistično obdelavo podatkov, uporabo programov R, MathLab ipd…

eng:
Introduction
Wood based materials are CO2-neutral, renewable, and considered to be environmentally friendly. The huge variety of wood species and wood-based composites allows a wide scope of creative and aesthetic alternatives to materials with higher environmental impacts during production, use and disposal. Modern building and construction practice would not be possible without use of wood and wood based composites. They include a range of derivative wood products which are produced by binding the fibers, strands, particles, veneers or boards of wood with adhesives, or other methods of fixation. This approach enables use of wood of lower quality for production of materials with engineered properties for specific, target applications.
During their service life, wood based buildings and building components are exposed to a wide variety of environmental conditions. For wood and wood-based materials, moisture stress and biological factors like mould, blue-stain, and decay fungi are often critical, especially for cladding and decking. Service life prediction, service life cost analysis, and the aesthetic performance of newly available bio-based building materials are essential for their promotion and increased use in the construction sector. Unfortunately the majority of the European wood species does not have durable wood. Protective measures are therefore unavoidable for many outdoor applications, where wood is exposed to weather or is in contact with the ground. These techniques includes: application of biocides, water repellents, surface coatings, protection by construction, development of new generation of composites … Resistance of wood against different aging factors is always a combined effect of toxic or inhibiting ingredients on one hand, and of structural, anatomical or chemical ways of exclusion of moisture, which is one of the most important factors for deterioration. Hence, special attention should be place in water exclusion efficacy - hydrophobisation of wood with coatings and other hydrophobic agents. The appearance of bio-based building materials is changing during their service life. Therefore, the aesthetic service life is often a decisive criterion for these applications, what needs to be considered.

Objectives
Durability is one of the most important decisive criteria for selection of wood in outdoor applications. Classification of wood is based on the mass loss, and/or performance in in ground outdoor test. However, recent studies indicates that the outdoor performance of wood is always a combined effect of toxic or inhibiting ingredients on one hand, and of structural, anatomical or chemical ways of exclusion of moisture. Therefore, we will determine the resistance dose DRd, as the product of the critical dose Dcrit and two factors taking into account the wetting ability of wood (kwa) and its inherent durability (kinh) will be determined in the laboratory. This approach will be applied on invasive wood species, underutilised wood species, wood treated with novel preservative solutions, modified wood ...

Data obtained within laboratory tests, will be compared to the performance of wood in filed trials. Resarch team has established filed test sites on four locations in Slovenia (Ljubljana, Ig, Bilje, Koper), what enables comparison of climate conditions on performance of wood in outdoor applications. There are more than 3000 sample exposed already, that will be regularly monitored, and assessed. Special emphasis will be given to assessment of performance of wood composites in outdoor application, where properties of wood (decay, colour discoloration, cracking, mechanical properties …) as well as the properties of adhesives in composites exposed in outdoor conditions will be regularly assessed. Moisture content of the wood during outdoor exposure will be continuously monitored and linked to the decay rate and resistance dose determined.
The importance of the aesthetic performance of wood is increasing and the colour is one of the most important parameters of aesthetics, hence the colour stability of several wood-based materials will evaluated by several in-service and laboratory tests. Discolouration of wood in outdoor applications is a long-known phenomenon, which is a result of different biotic and abiotic causes. The ongoing in-service trial started in October 2013, hence there is long time series of colour changes available what enables detailed comparison of laboratory and filed test data. In addition, respective colour changes are suitable for modelling and prediction of colour changes and incorporation into Building information modelling software, what will enable easier decision for customers.

Education and experiences:
Material science, Wood Science and Technology, Natural sciences, Technical sciences.
Experiences with analytical equipment used in respective laboratories are acknowledged
Candidates with experiences with data processing are expected. Resarch work will involve work with a lot of information, and require (will require) advanced use of Excel, statistical programs, and programs for analysis like R, MathLab …