Summary for the final report

Algae Compound and Carbohydrate Extracts for food Products and sustainable packaging Technology (ACCEPT)

Due to their rapid growth, sustainable extraction and valuable ingredients, algae have enormous potential for a future bio-based circular economy. The structural polysaccharides, such as alginate, carrageenan and agar, are already used industrially as food additives or for technical applications. Coatings of algal polysaccharides on packaging films can drastically improve their barrier against oxygen - this is usually mandatory for the protection of food from oxidation and spoilage. Therefore, they provide a potential bio-based alternative to fossil-based coatings and are also biodegradable. Within the scope of ACCEPT, the utilization of marine algae as a raw material for biobased packaging material as well as a natural pesticide on crop plants was tested. Therefore, marine algae that are naturally occurring at beaches in northeastern Brazil were collected, purified and dried. A part of the collected algae was processed in Brazil into aqueous extracts and tested as a natural pesticide for crop plants. Another part of the collected algae biomass was processed at Fraunhofer IVV using a fractionated extraction process with the challenge to obtain the purest possible extracts from the natural algae mix, which possess a consistent chemical composition and controllable technofunctional properties. The extraction processes were initially developed in lab-scale with cultivated algae with a known composition and then transferred to Brazilian beach cast algae at Fraunhofer IVV's plants.

The obtained extracts were used to produce cast films and coatings on paper. In addition to that, pure phycocolloids were examined for their potential barrier in native and modified form. Through different chemical modifications (ionic and covalent cross-linking) of the polysaccharides, it was tested if it is possible to increase their resistance to moisture whilst maintaining a good oxygen barrier. Besides different modification methods, the influence of the formulations viscosity as well as plasticizer types and content was evaluated. The effect of different paper substrates was also investigated. To shield the phycocolloid coatings from moisture, different top coatings were used.

The cast films and coated papers were mainly characterized regarding their oxygen barrier (OTR) and grease resistance. The best combination resulted in an OTR of 2.3 $cm^3/(m^2*d*bar)$ with a coating thickness of 4 µm on paper at 23 °C, 50 % r.h. All of the phycocolloids showed good grease resistance when a closed layer was achieved. Since these results could not be reached with the beach cast extracts a further optimization of raw material preparation and extraction process is necessary. However, when the pure phycocolloids which performed good on their own were mixed in a similar composition as the beach cast extracts, the oxygen barrier decreased. This indicates that only the pure phycocolloids deliver a good oxygen barrier and grease resistance.

To allow a further processing into packaging material the moisture resistance needs to be improved and sealability needs to be accomplished. With the attained barrier properties the material could be used for dry, oxygen sensitive products that might also need some grease resistance. Additionally, the cast films could be developed into larger free standing films.

IVLV members can download the complete final German project report from our homepage. All you need is to register in the section “My IVLV”. Non-members can request the final report from the IVLV office at office@ivlv.org .

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