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## Properties of new dextrans designed using dextransucrase mutants

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Biopolymers such as polysaccharides are widely used as thickening, stabilizing or gelling agents. They are generally extracted from plants (e.g. starch, pectin, cellulose) or algae (e.g. agar, carrageenan) but some of them are also produced by microbial fermentations (xanthan, gellan,  $\beta$ -glucans, bacterial cellulose, pullulan, for instance). As they are also of interest as biodegradable materials which could be used for packaging, the ability of plant and algae polysaccharides and microbial polysaccharides to form films has been explored these last years. In this context,  $\alpha$ -glucans synthesized from sucrose by the glucansucrases (GS) from lactic acid bacteria of the genus *Leuconostoc*, *Streptococcus*, *Lactobacillus*, *Exigobacterium* and *Weissella* could offer an alternative source of biopolymers. Glucansucrases (GS) are transglucosidases classified into the family 70 of the Glycoside-Hydrolases, that are able to polymerize the D-glucosyl units of sucrose to form high molar mass homopolysaccharides. Depending on the reaction conditions, these versatile biocatalysts are able to synthesize a wide range of  $\alpha$ -glucans and oligosaccharides varying in terms of size and osidic linkage type.

The structural and physico-chemical properties of seven high molar mass  $\alpha$ -glucans synthesized *in vitro* from sucrose by mutants of dextransucrase DSR-S from *Leuconostoc mesenteroides* NRRL B-512F, obtained by combinatorial engineering, were described to evaluate their applicative potential as bio-sourced materials. These original biopolymers display from 3 to 20%  $\alpha(1 \rightarrow 3)$  glycosidic linkages. Using asymmetrical flow field flow fractionation coupled with multiangle laser light scattering (AFFFF-MALLS), it was determined that weight average molar masses and radii of gyration range from 0.76 to 6.02 x 10<sup>8</sup> g.mol<sup>-1</sup> and from 55 to 206 nm, respectively. These measurements enabled to clusterize these polymers in three groups, regarding their molar mass, size and branching patterns: (i) Gcn1, which displays the highest  $\overline{M}_w$  and a quasi-linear conformation with only 3%  $\alpha(1 \rightarrow 3)$  linkages, (ii) Gcn6 and Gcn7, the smallest  $\alpha$ -glucans, which contain 15 and 20%  $\alpha(1 \rightarrow 3)$  linkages, are highly branched and contain long ramifications, and (iii) the other  $\alpha$ -glucans displaying intermediate structures.

Rheological investigation shows that all of these polymers present a classical non-Newtonian pseudoplastic behavior. However, Gcn\_Dv $\Delta$ 4N, Gcn2, Gcn3 and Gcn7 form weak gels, while others display a viscoelastic behavior that is typical of entangled polymer solutions. Finally, glass transition temperature  $T_g$  was measured by differential scanning calorimetry. Interestingly, the  $T_g$  of Gcn1 and Gcn5 are equal to 19.0 and 29.8°C, respectively. Because of this low  $T_g$ , these two original dextrans are able to form rubber and flexible films at ambient temperature without any plasticizer addition. The mechanical parameters determined for Gcn1 films from tensile tests are very promising in comparison to the films obtained with other polysaccharides extracted from plants, algae or microbial fermentation. These results lead the way to using these dextrans as innovative bio-sourced materials and biodegradable films.