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Ale, Marcel Tutor; Maruyama, Hiroko; Tamauchi, Hidekazu; Meyer, Anne S.

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Extraction and bioactivity assessment of Fucoidan from brown seaweed

Marcel Tutor Ale, Hiroko Maruyama, Hidekazu Tamauchi, Jørn Dalgaard Mikkelsen, Anne Meyer
Center for Bioprocess Engineering (BioEng), DTU-Chemical Engineering, Saltofts Plads Bldg. 229, 2800 Kgs. Lyngby. Email: mta@kt.dtu.dk

Introduction

Fucoidan is a term used for a class of sulfated, fucose rich, polysaccharides extracted from brown seaweeds. These fucose-containing sulfated polysaccharides (FCSPs) principally consist of a backbone of (1→3)- and (1→4)- α-linked -L-fucopyranose residues, that may be organized in stretches of (1→3)-α-fucan or of alternating α(1→3)- and α(1→4)-bonded L-fucopyranose residues with sulfate on C-2 or C-4 and rarely on C-3. A range of biological activities have been attributed to FCSPs including anti-tumour, anti-viral, anti-inflammatory, and notably anticoagulant effects. Therefore special interest for potential pharmaceutical, medical, cosmetics and food applications of FCSPs have recently directed into utilization of brown seaweeds as a source of FCSPs and/or Fucoidan.

Extraction technology

Classical extraction of fucoidan typically involves extended, multiple-step, hot acid, or CaCl₂ treatments, each step lasting several hours. In this work, we systematically examined the influence of acid concentration (HCl), time, and temperature on the yield of FCSPs in statistically designed two-step and single-step multifactorial extraction experiments.

Designed optimized extraction

Response surface model predicted the maximum polysaccharide (i.e. FCSPs) yield of ~8% DW from Sargassum sp. would be obtained at 0.03 M HCl/90°C/4 h.

Anti-cancer and immune response

Natural Killer cells activity is crucial in immune surveillance against tumors. Fucoidan exerts anti-tumor activity through an enhancement of the immune-response notably NK cells activation. The bioactive effect of Fucoidan on skin-cancer cells was facilitated via induction of apoptosis through cascades of reaction initiated by activation of caspases-3.

Conclusion

A simple and practical method for recovering fucose-containing sulfated polysaccharides from Sargassum henslowianum has been established. Clearly, yield and chemical composition of the product are strongly affected by the method of extraction. Extraction technology has a major bearing on any study in which such products are being evaluated for biological activity. The work also evidently indicates that FCSPs and/or Fucoidan from both Sargassum henslowianum C. Agardh and Fucus vesiculosus may have therapeutic potential as skin-cancer preventive agents.