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Carboxymethyl chitosan (CMCH): A water-soluble derivative of chitosan

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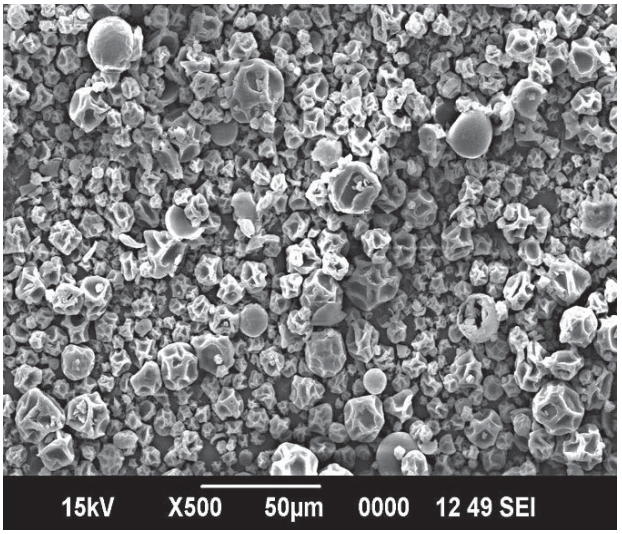
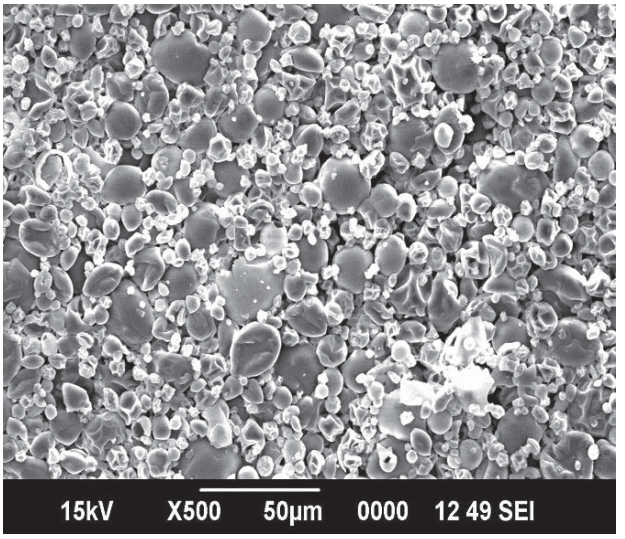
The structural uniqueness of chitosan facilitates the modification of its functional moieties which permits flexible manipulation of its biological and engineering properties. However, the poor solubility of chitosan at neutral pH poses practical difficulties in applications. To overcome this technological demerit, various chemical modifications have been suggested. Among these, carboxymethylation has often been applied to improve water solubility to chitosan. Fish Processing Division of ICAR-CIFT has standardised a cost-effective protocol for the production of Carboxymethyl chitosan at pilot scale. CMCH holds several bioactive and physicochemical properties, which are evensuperiorto those of native chitosan. Hence, itis considered as a promising candidate for biomedical applications such as drug carriers, antimicrobial material, gene delivery systems and tissue regeneration devices. As per our laboratory developed method, the properties of CMCH can be tailor-made to fit the requirements of these wider range of applications. In order to derive standardized combinations of process parameters to yield CM-chtosan with a defined set of properties for specific applications, a series of 18 trials were conducted. The properties of CM-chitosan incubated at various reaction temperatures ranging from 10-60ºC for different durations of 1-3 hrs were evaluated. The results indicated a distinct reduction in the solubility of CMCH below 40ºC, whereas only a marginal difference in solubility was observed between the samples incubated at



nCH



CMCH

higher temperatures for longer durations. The prepared CMCH was found to have good adjuvant properties when incorporated in foliar spray. The unique properties of prepared CM-chitosan such as high viscosity, large hydrodynamic volume, gelling ability, besides its excellent solubility at neutral pH, make it an attractive option for its use as functional ingredient in processing and preservation of wet and dry commodities. The excellent hydrophilic characteristics of CMCH along with itsresemblances with the components of extracellular matrix, antibacterial and antioxidant properties, surface- active and gel-forming capabilities, all can be well exploited and emphasized for cosmetic applications.

***Comparison of microencapsulation efficiency** of CMCH against native chitosan*

The suitability of CMCH to use as wall polymer for encapsulating squid extractives was evaluated. The encapsulates were characterised for structural and storage stability and the results were further compared against the properties of encapsulatesprepared with native chitosan (nCH). In order to maintain the hydrophilic-lipophilic balance, omega 3 fish oil was added before emulsification. The microscopic images indicated certain extent of coagulation in nCH emulsion, whereas CMCH emulsion remained stable for more than 24 hrs without any evidences of phase separation. The SEM images indicated the formation of spherical encapsulates in CMCH powder, whereas a large number of shrunken capsules were visible in spray dried nCH encapsulate powder.

The film forming properties of water-soluble chitosan was compared against that of native chitosan. The tensile analysis of the films indicated a 20 fold higher tensile strength value for nCH chitosan film compared to that of CMCH chitosan. However, the elongation at break value registered for water-soluble chitosan film was 10 fold higher than that of nCH film. The vapour barrier properties of CMCH film was found to be inferior as indicated by the higher water vapour transmission value.