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Encapsulated whey for stock-feed

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The major hurdles in whey utilization are associated with low solid content (6%), short shelf life and relatively high processing costs, such as ultrafiltration, concentration and spray drying. While for large scale manufacturers, it is feasible to invest in these technologies to produce whey proteins and lactose, small and medium scale manufacturers still spray the whey onto land or discharge into waste stream. For each kg of cheese, 9 kg of whey is produced. Around 280 Million L of whey is disposed in Australia and 60 billion L globally. Whey proteins are rich in essential amino acids and have the highest biological value amongst other proteins. Clearly, to utilize whey, a low cost step that can eliminate the energy intensive processes would be a significant step forward for the dairy industry toward more sustainable dairy processing. Using biopolymers, 50-70% of whey proteins can be captured in a one-step simple and low cost process and resulting protein biopolymer complex can be used as stock-feed. The dry complex contains 50% whey protein, has similar amino acid profile to fish meal and highly digestible. Lactose rich deproteinated whey still needs to be utilized but the whey volume and the BOD are reduced.

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Design and optimization of pilot scale ohmic-based carrageenan extraction technology

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Justification: Carrageenans are important hydrocolloids extracted from red seaweeds (*Rhodophyceae*) of genus *Eucheuma, Iridiae, Gigartina, and Chondrus*. Carrageenan extraction technologies currently applied in industries are based on conventional heating using double-jacketed tanks supplied with steam as heating medium or using diesel-oil burners for heating the cooking tanks from underneath. These technologies are inefficient in energy use and in the case of heating in double jacketed tanks; a complicated processing setup is encountered because of the need for dedicated steam generator and a steam delivery system.

Objective: The objectives of this study were to develop an ohmic-based novel technology for seaweed processing and to perform experiments to obtain an optimal processing condition for carrageenan extraction.

Methods: The system developed consisted of three ohmic heating chambers (7.5 liter each) working in parallel, a 100-liter tank and a pump. The extracting medium can be circulated within the system, from the tank to the ohmic chambers and back to the tank using the pump. The optimization of process parameters was conducted using response surface methodology (RSM). A four factor central composite design (CCD) was used to develop a statistical model to optimize extraction yield. The experimental parameters were extraction temperature and time, KOH concentration and seaweed to solution ratio.

Results & Significance: The results of this study showed that carrageenan can be effectively extracted from seaweeds using ohmic technology with yields above 70 percent. Optimal processing conditions for extraction of *iota* carrageenan from *Eucheuma spinosum and kappa carrageenan from Kappaphycus alvarezii* have been identified.

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