A mechanical deproteinization system for the chitin production line

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India exported around 590275 Mt of frozen shrimp in the fiscal year 2020-2021 (MPEDA,2021) and peeled shrimp (deveined and undeveined) formed the major part. During pre-processing operations of shrimp/prawn, about 60 per cent material handled is generated as shell/head discards. Prawn shell contains protein, minerals and chitin as the major constituents. A portion of these discards is utilised for making chitin which has a lot of industrial applications.

The conventional method of chitin extraction primarily involves deprotei-nization and demineralisation processes. Deproteinization is chemically achieved using 3 % sodium hydroxide and deminera-lisation by dilute hydrochloric acid. The separated protein solution and mineral solution are normally mixed together for neutralisation and settling, and the aqueous portion is sent to the treatment unit.

ICAR-CFT has developed a machine for separating the protein by mechanical means after repeated trials. The unit can effectively remove the protein as a thick slurry. The machine is attached with a 2hp motor and has a capacity of 100 kg per hour for separating protein. This machine can be upscaled as per the requirement of the industry.

The protein slurry separated is found to be about 42-50 % of the total weight of the shell, which may vary according to species. The volume of the shell after processing has also reduced to 40 percent of the actual volume, which inturn reduces the transportation cost of the shell material to the chitin manufacturing units. *The compositional analysis of protein liquor separated has indicated 80 % moisture, 10 % protein, 3 % fat and 2-3 % ash.*

Uniqueness of the technology

This process is relatively a clean process, i.e. almost all waste produced are recycled off-site. The use of chemicals at each stage of extraction and the organic load in the effluent line is considerably reduced. The NaOH used in the deacetylation step can be reused in the initial deproteinization of shell after dilution. Astaxanthin, a carotenoid pigment found in shrimp shells is recovered from the press liquor. This pigment is very valuable mainly in the medical field and hence has high sale value. Astaxanthin has also got immense potential as an animal and aquafeed supplement. The carotenoprotein-rich slurry separated during the process is a good source of protein. Apart from that, the slurry serves as a good source of nitrogen and can be best utilized for foliar spray and manure production.

The process of separation of protein before the chemical extraction has multiple advantages.

- The volume of shells handled can be reduced, which enables handling and processing of more quantity in the given time.
- The quantity of alkali used for deproteinization can be reduced considerably resulting in the reduction of the process cost.
- Because of the use of the reduced quantity of alkali, the quality of both chitin and chitosan is far better than the normal chitin.
- This process enhances the quality of discharge effluent water since most of the protein and pigments are removed during the initial separation itself.
- The spent acid after demineralisation process can be reused after enhancing the concentration, resulting in reduced water use.

References:

MPEDA,(2021) Annual Report 2021, The Marine Products Export Development Authority, Kochi, 323p.