Technical Article- HIGH MOISTURE MEAT (HMMA) THROUGH XTRUSION COOKING OF SOY PROTEINS & MICROALGAE

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With growth of population increases the demand of food . Both Animal and Vegan based. Increasing group of consumers are now demanding alternatives to Animal source of meat and plant source proteins can help us to develop a Mimicry Animal Meat Analogue product, tastes and flavors like Animal meat but is environmental friendly. Moreover, increasing trend being towards saving lives of Animals over the world, HMMA is a good substitute to meet the needs of Meat consumption while retaining the taste and feel of muscle meat products. HMMA tastes and feels like Animal muscle meat and can have equivalent nutritional value. Further advantages would be it avoids disease transmittance from animal to consumer, saving animal lives, and economical reasons.

The Raw materials used is mainly soy protein (SP) concentrate powder either singly or with microalgae or other plant, pea proteins, to keep 100% vegan friendly meeting their nutritional requirements, while non vegans too can have almost the same taste and feel of animal muscle meat, at low cost while saving several animal lives. Microalge (MA) is charatericised by dried Auxenochlorella protothecoides, form of cultivated algae which is sometimes used with SP to provide good feel of product. Defatted soy protein powder used along with MA also provides good texture and elastic properties' to the extruded HMMA, almost resembling Muscle of Animal meat, While approved colorant could sometimes be added to provide almost Animal muscle colour.

HMMA with their high moisture content (typically>50%upto70%) when made out of SP and MA have resemblance of Animal meat texture and taste, while costing less to produce.

Process:

Extrusion is the process used for producing HMMA. A Co-rotating Twin screw Extruder is preferable to produce HMMA and is made by proper concentrations of SP with plant proteins or with MA, with high moisture levels. However, the water preferably @ 70 C needs to be introduced online into the Extruder just ahead of Feeding zone through accurate Dosing Piston pumps. Further2separatefeeders are necessary, one each for SP and MA or other plant protein, because the degree of loading greatly affects the final

texture and properties of HMMA. It is found, that, increasing levels of MA also influences the texturisation and elastic properties which needs to be compensated by reducing the moisture levels to maintain the required texture and strength of HMMA. Inside the Extruder, products are maintained from20-170C tempt gradient through various zones.

The TSE, due to its co-rotating action will knead, mix and further cook the ingredients by Thermomechanical processing, heat being supplied by external heaters plus generation of adiabatic heat due to mechanical shear provided to raw materials. The Texturisation zone, or the Die (Slot die) provides not only to shape the product, but also give characteristic texture to the product by cooling down and inducing texturisation by maintaining tempt to<100C at exit. The flat product can be cut as sheet or into cubes, vacuum packed and stored at low temperatures.

Having said that, single screw cooling extruder has also been used with separate feeding, kneading, mixing, delivery sections with suitable die to achieve the result, though at less capital investment. With new screw designs and manufacturing, single screws can do good job at low initial investment.

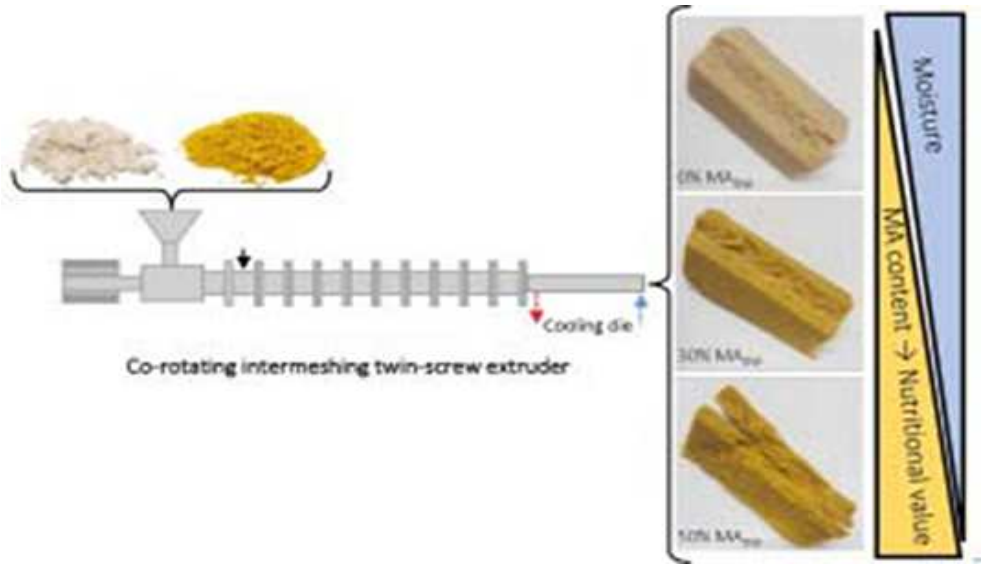

Fig. 1. Fibrillary structure in extrudates produced via Extrusion cooking with different proportions of MA: (a) 0% MADW – 65% moisture, (b) 30% MADW – 60% moisture, and (c)
50% MADW – 55% moisture. (d) Changes in color and texture of extrudates with increasing MA content and optimized moisture contents.

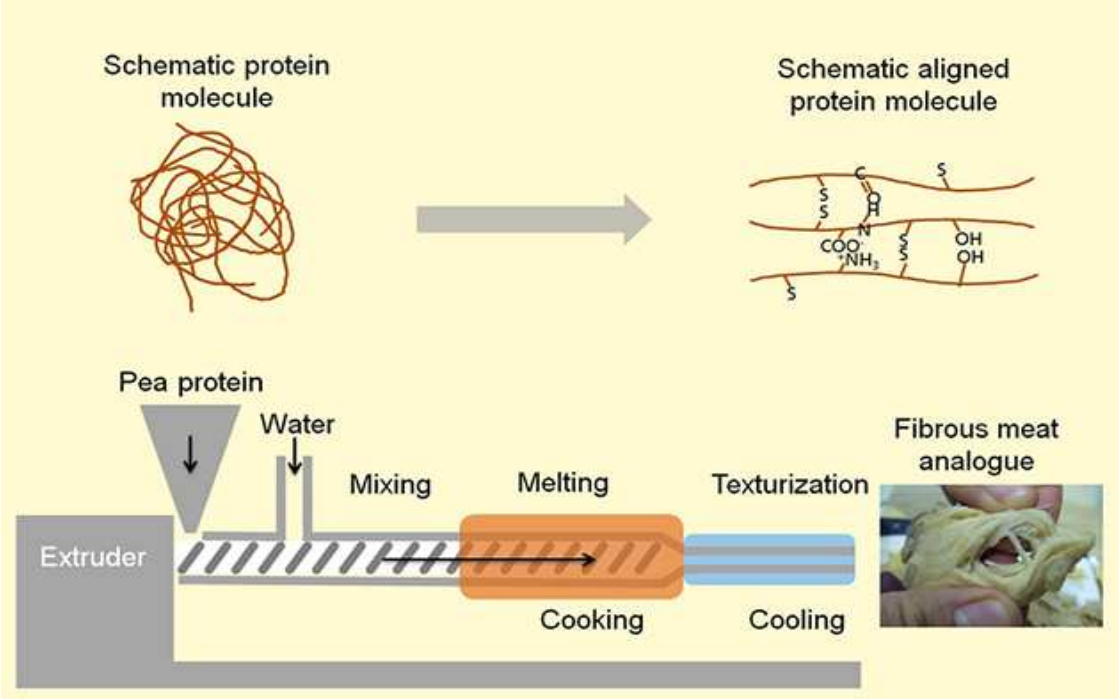

Fig 2. SINGLE SCREW EXTRUSION OF HMMA

Fig.3 .The Trial product emerging through the Slot Die.

Conclusion: Understanding of the High-moisture extrusion process is still limited. Additional studies need to conducted to develop understanding
about the fiber formation. However, it is so far understood that we need to have an accurate extruder parameter for the production
of meat analogues with a fibrous structure. Food industry should promote the meat analogues from a niche market to a sustainable and larger market in the future.

Single Screw Extruder for producing HMMA products.

Laboratory Twin Screw Extruder for Research application

End of Article.