

maltodextrin. The efficacy of hydrolysate as wall material was evaluated by replacing the sodium caseinate and keeping the proportion of all other polymers constant. Oil encapsulate was also prepared with tuna protein hydrolysate as core material together with sardine oil to evaluate the extent of protection offered against auto-oxidation of fish oil. Oil encapsulates were characterised based on morphological, physical parameters including SEM, DSC, FTIR as well as fatty acid profile, encapsulation efficiency, flow properties, colour, moisture, hygroscopicity and invitro digestibility studies. Storage studies of sardine oil and oil encapsulates under accelerated (60°C), chilled (4°C) and room temperature conditions indicated better oxidative protection to oil encapsulates compared to liquid oil. Tuna protein hydrolysate had more protection efficiency against fish oil oxidation when used as core material than when used as wall material.

#### AW 12

### Development of a smart packaging system for monitoring and managing fish spoilage

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Smart packaging, the combination of active and intelligent packaging, which on the one hand monitors changes in the product (intelligent) and on the other hand acts upon these changes (active), is a promising concept. In the present study, a smart packaging system combining freshness indicators and antimicrobial film was used for monitoring and managing

spoilage of barracuda fish (*Sphyraena jello*) steaks stored at 2°C. Antimicrobial film was prepared from shrimp shell derived chitosan (CH) added with ginger (*Zingiber officinale*) essential oil (GEO). GEO incorporation improved antimicrobial activity, antioxidant capacity, water barrier property and thermal stability of CH films. GEO at lower concentrations didn't significantly ( $p>0.05$ ) affect the mechanical properties of CH film. FTIR (Fourier transform infrared spectroscopy) spectra indicated that functional groups of phenolic compounds were more recognizable with increasing GEO concentration in CH film. As observed from scanning electron microscopy (SEM) of the film, presence of GEO resulted in a heterogenous structure in CH film. Volatile base formation and microbial growth in barracuda steaks packed with CH-GEO film were significantly ( $p<0.05$ ) lower than control. pH sensitive dyes were used as freshness indicators to monitor the quality of chill stored barracuda steaks. Among the various dyes used, bromocresol purple was the most effective visual indicator of barracuda deterioration. The results of the present study indicate that CH-GEO film is an effective packaging material with potential bioactivities for improving the keeping quality of fish steaks and synergistic use of freshness indicator and antimicrobial film can provide the consumers a more safe fish.

#### AW 13

### Life Cycle Assessment (LCA) based identification of environmental hotspots in commercial trawl fisheries and mitigation strategies

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