## ABSTRACT

The Indian fish market is mainly dominated by carp, which has a major portion of scales that are discarded as waste, creating environmental pollution. Fish scale mainly composed of hydroxyapatite (HAP) (mineral) and collagen (protein). *Labeo rohita* scale was fractionated for separation of HAP and protein through treatment with potassium hydroxide, phosphoric acid, and ammonium sulfate following a green technology. The characterization of HAP was done through thermogravimetric analysis, X-ray diffraction, scanning electron microscopy, energy dispersive X-ray study and particle size distribution. The protein part was converted to fish scale glue (FSG) and used for wood joint, paper joint and production of particleboard along with rice straw. The effluent generated through simultaneous recovery of collagen and HAP, applied as a fertilizer in liquid form as LFSE (Liquid fish scale effluent) for corn and okra (ladies finger) plants and in dried form as FSE (Fish scale effluent) for paddy, wheat and capsicum plants. Different concentrations of LFSE and FSE ranging from 0.5-20% were applied in various combinations.

The HAP powder after isolation from scale contained less than 7% organic matter and had a Ca:P ratio of 1.52. The tensile strength, shear strength of wood joint, peel strength of paper joint and puncture strength of particle board were found as  $0.390 \text{ N/mm}^2$ ,  $0.246 \text{ N/mm}^2$ , 0.104 N/mm and 0.80-1.24 MPa, respectively. The mean failure height of particleboard during drop test was found as  $265\pm10.83$  cm. The moisture content of the particleboard was found to be dependent on  $a_w$  (Equilibrium relative humidity) of the environment. For paddy, 2% FSE (w/v) solution resulted in highest plant height at maturity (98 cm), effective tillers (22.2/plant) and paddy production (44.2 g filled grain/plant). The brown rice contained protein, fat, fiber, ash, and carbohydrate as 7.40%, 1.71%, 0.93%, 1.11% and 75.35%, respectively. Wheat plants gained maximum height (55-59 cm) for 1-3% FSE and SF, maximum tillers (7.50-8.75/plant) for 1.5-3% FSE and highest yield (3.28 g/plant) for 2% FSE treated plant. For capsicum, highest plant height (28.71 cm) was seen for 2% FSE treatment and highest yield for 0.5% FSE treatment. There was no significant growth seen in okra and corn. The green technology for production of HAP and collagen reported in this study may be used with other fish scales.

*Keywords*: *Labeo rohita* scale, Waste minimization, Green technology, Hydroxyapatite, Fish scale fertilizer