Biodegradable ropes from seaweed extracts

A research team from the CSIR–Central Salt and Marine Chemicals Research Institute, Bhavnagar, Gujarat has developed a biodegradable material made of seaweed extracts to replace synthetic ropes that are used in seaweed farming and other applications.

Seaweeds are cultivated along coasts using low-technology methods (see Box 1). Seaweed seedlings are tied to ropes strung on a wooden frame. These frames are then left submerged in shallow sea water. Fuelled by the energy gained from photosynthesis using sunlight and the nutrients that the tides bring in, the seedlings are ready to be harvested in 6–8 weeks.

Box 1. Seaweed farming.

Seaweed farming has been an ancient practice in East Asian countries like Japan and China. This practice has now spread to many other countries like USA, UK and even India as an alternative, or to supplement income among the fishing community. Rich in iodine and vitamins B12 and A, many seaweed species have been termed 'super foods'. Apart from being used as food, they are cultivated and harvested in great quantities for commercial use like in preparation of agar-agar (used as a medium for cultures in laboratories) and for carrageenan extracts that are widely used in the food industry as thickening or stabilizing agents.

Wooden frames used in seaweed farming (photo credit: www.hindu.com)

Figure 1. Seaweed seedlings tied to the biodegradable rope made from seaweed extracts (photo credit: Ramavatar Meena).

Synthetic ropes are used to tie seaweed seedlings, as ropes made of cotton or jute disintegrate quickly in saline water. Though synthetic ropes last longer, being non-biodegradable they are hazardous to the environment. Chaudhary *et al.*[1] have now developed an eco-friendly material that can tolerate saline water conditions and is also biodegradable.

Polysaccharides extracted from three seaweed species *Gracilaria dura*, *Gelidiella acerosa* and *Kappaphyucus alvarezi*, were first heated and then treated with potassium persulphate, vinyl acetate and glycerol to make them tolerant to saline water. Once the mixture is cooled, it was moulded into ropes and used to replace the synthetic ones used to tie the seedlings in seaweed farming (Figure 1).

The durability and strength of the ropes were tested both under laboratory and field conditions. It was found that the rope made from seaweed extracts lasted over 45 days in the field and over six months in sea water under laboratory conditions. The tensile strength of the rope was higher (65 MPa) than that of the synthetic ropes and therefore suitable to be used as its substitute.

The authors[1] believe that large-scale manufacturing of this material can replace plastic in many ways. 'The polysaccharide extract is not just suitable for making ropes but can replace plastic in many other forms like packing material, clothes drying rope, bag handles and other home decor items' says Ramavatar Meena, one of the senior authors.

1. Chaudhary, J. P., Chejara, D. R., Eswaran, K., Meena, R. and Ghosh, P. K., *RSC Adv.*, 2015, **5**, 19426.

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