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ARTIFICIAL SEAWEED

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ABSTRACT OF THE DISCLOSURE

An improved form of "artificial seaweed" for combating coastal erosion and the like comprises an anchored array of filamentary strands of foamed, stretched polyolefin, characterized by a internal plexiform structure surrounded by a substantially closed, thin skin, having a tensile strength of at least about 1 gram per denier and a final density below 500 g./l.

This invention is directed to an improvement in artificial seaweed, comprised of assemblages of polyolefin strands. Such assemblages are useful as a means for influencing the migration of material at the bottom of bodies of water, as in combating coastal erosion.

As known heretofore and described, for example, in British Pat. 984,077 to Roblon, such a protective assemblage of artificial seaweed consists of a wide screen formed by a large series of filamentary plastic elements or strands which are secured at one end to an anchoring means to be placed at the bottom of the sea. The strands have a lower density than water so that the screen formed of these elements will assume and retain an upright position in the water, thereby reducing currents in the surrounding water and promoting the deposition of sand or other solid materials entrained by the water. Erosion of sea-floors in coastal waters, which is sometime a serious problem in the absence of sea vegetation, can thus be successfully combated. A similar problem is experienced with structures erected on the sea-bottom, like landing-stages, piers and fixed drilling platforms, where strong currents and turbulence around the foundation piles and beams may erode the sea-bottom and wash out the foundation. By providing a zone protected by artificial seaweed around the bottom end of the support members of the foundation, the scouring action of the sea no longer endangers the stability of the foundation.

The filamentary elements known heretofore can be formed by a plurality of single or composite strands of a thermoplastic material. The strands may be solid material if the density of this material is less than that of water. It has also been proposed to use single hollow fibers closed at either end.

None of the heretofore disclosed materials has proved very satisfactory for use as artificial seaweed. Some of the elements lack strength or sufficient buoyancy, others do not have the desired low density or, as in the case of the individual hollow fibers, are expensive to make. Since any adequate protection of a coastal area requires huge quantities in volume of the seaweed, only low-cost, easy-to-produce materials are feasible for this purpose.

It is the object of the invention to provide artificial seaweed that performs well for prolonged periods and which can be made simply and at low cost.

Artificial seaweed, according to the invention, comprises a plurality of elongated, flexible, buoyant strands, such as filaments or tapes, secured to anchoring means adapted to maintained the elements near the bottom of a body of water, said elements having been formed by extruding multicellular foam strands of a polyolefinic material having a density less than 300 g./l., and subsequently stretching the strands in a ratio of at least 5:1. The resulting strands are thin elongated flexible elements having an open plexiform network structure surrounded with a substantially closed, thin-walled skin.

The material of the elements is preferably polypropylene. The extruded polypropylene foam strands have a cellular structure. The extrusive conditions are controlled to provide strands having a measured density of no more than 300 g./l. The extruded, unstretched strands are relatively weak, having typically a tensile strength of about 0.1 g./denier. After being stretched at a ratio of at least 5:1, the strands have an open, plexiform structure rather than a cellular structure, and have a greatly improved tensile strength, for example, between 1 and 5 grams per denier. Therefore, the stretched foam strands are tens of times stronger than the unstretched foam strands. The improved tensile strength is not only of importance to prolong the useful life of the seaweed under water but also to avoid excessive waste by breakage during manufacture of the seaweed, when the elements are being tied to an anchoring device, and during the subsequent handling and transportation.

In spite of the open internal structure of the elements, no substantial volume of water can penetrate into them because they have a relatively unbroken outer skin and because polypropylene is a nonwater absorbent material. The air within the elements remains entrapped even under relatively highfluid pressures and continues to contribute greatly to the buoyancy of the elements.

Foamed strands suitable for conversion to the articles of this invention are produced by the methods described in detail in Netherlands patent applications 6511455, published Mar. 3, 1967 and 6610834, published Feb. 5, 1968. In these methods, polypropylene is admixed with a volatilizable fluid blowing agent which expands when a melt of polypropylene and blowing agent is extruded into a zone of lower pressure, e.g., from an extruder into the atmosphere. A small proportion of a chemically decomposable blowing agent may be present as a foam nucleating agent for the volatilizable fluid blowing agent.

The stretching is suitably performed at elevated temperatures, for polypropylene usually between 110° and 165° C. The stretching ratio of the extruded foam strands may be between 5:1 and 15:1, and preferably between 7:1 and 10:1.

The length of the elements can be selected to requirement, but an average will be from 3 to 10 feet. Since the elements have a lower density than water, they must be anchored to the sea floor. Various anchoring means may be selected; for example, the elements may be secured at one end in bundles to concrete blocks. It is desirable that the elements form an uninterrupted screen in the water, and therefore, the elements are preferably connected in closely related linear arrangement to an elongated anchoring device, such as a steel cable. Each element can be clamped to the cable at a middle portion thus leaving both ends free and seemingly forming two elements of half the original length. Other suitable anchoring devices are chains, rings, and small sand bags. The elements can be arranged individually, or a unitary structure of woven or otherwise interconnected elements can be formed.

In practice, stretched and extruded polypropylene foam strands, according to this invention, were found to perform very well as an artificial seaweed; the problem of vulnerability and easy breakage experienced with unstretched foam strands was overcome by the stretching operation. Although the density of the foam strands increases when being stretched, this imposes no problem at all since the density of the stretched elements still remains below 500 g./l., and hence much less than that of water. For example, isotactic polypropylene (melt index 8) foam strands having a density after extrusion of 34 g./l. were stretched at a ratio of 13:1 at 164° C. and thereby obtained a final

density of 178 g./l. In another case, polypropylene foam strands with a density of 28 g./l. were stretched at a ratio of 9:1 at 162° C., resulting in a final density of 107 g./l.

The final density of a stretched foam strand was calculated by determining its weight and volume, the latter established by submersion in a water bath. Since the strands have their open net-structure surrounded with a predominantly closed skin, little water will penetrate into the strands. However, since the volume measurement was made using a relatively short piece of strand, the water that might enter the strand at the ends thereof, where no protective skin is present, might influence the volume measurement too much, and for this reason, the ends of the sample strand had been sealed.

The foamed strands are suitably in the form of tapes having in cross-section a greatest dimension of 2.5 mm. and a smallest dimension of 0.5 mm. Generally satisfactory dimensions for the strands are a width between 1 and 10 mm. and a thickness between 0.25 and 4 mm.

I claim as my invention:

1. Means for influencing the migration of material at the bottom of bodies of water, comprising an array of elongated, flexible, polyolefin strands having a tensile strength of at least 1 g./den. and an internal plexiform structure surrounded by a substantially closed thin skin, said strands having been formed from extruded multicellular foam strands of a polyolefinic material, having a density less than 300 g./l., by stretching in a ratio of at 5:1, and being secured to anchoring means adapted to maintain the array near the bottom of a body of water.

2. Article according to claim 1 wherein said polyolefin is polypropylene.

3. Article according to claim 2 wherein said strands are tapes having, in cross-section, a greatest dimension in the range from 1 and 10 mm. and a smallest dimension in the range of 0.25 to 4 mm. and a density less than 500 grams per liter.

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