

#### **6.1.14. Sodium Alginate** (24)

Sodium alginate is the sodium salt form of alginic acid and gum extracted from the cell walls of brown algae, having chelating activity.

#### **Synonyms**

Sodium alginate and Sodium polymannuronate

**Source**

Sodium alginate is the sodium salt of alginic acid, which is a polyuronic acid containing reduced mannuronic and glucuronic acids obtained from the algal growth. The common species of algae are *Macrocystis pyrifera*, *Laminaria hyperborea*, *Laminaria digitata*, and *Ascophyllum nodosum*, all belonging to Phaeophyceae family. It is a purified carbohydrate extracted from brown seaweed (algae) by the treatment of dilute alkali.

**Occurrence and Distribution**

The seaweeds from which sodium alginate are obtained are found in Atlantic and Pacific oceans, along the coastal lines of Japan, the U.S.A., Canada, Australia, and Scotland. The U.S.A. and U.K. are the leading producers of sodium alginate. In India, it is found near the coast of Saurashtra.

**Organoleptic Evaluation**

- 1) **Colour:** White to buff coloured powder.
- 2) **Odour:** Odourless.
- 3) **Taste:** Tasteless.
- 4) **Appearance:** Available either as a coarse or fine powder.
- 5) **Solubility:** Readily soluble in water forming viscous colloidal solution; insoluble in alcohol, ether, chloroform and strong acids.

**Chemical Constituents**

Sodium alginate is the sodium salt of alginic acid, which is a linear polymer of L-guluronic acid and D-mannuronic acid. Its chain length is long (mol. wt. ranging from 35,000- $1.5 \times 10^6$ ), and varies with the isolation method and algae source. Sodium alginate contains **mannuronic acid** as the **major component**. The molecule of alginic acid appears to be a copolymer of 1,4-linked mannopyranosyluronic acid units, of 1,4-linked gulopyranosyluronic acid units, and of segments where the uronic acids alternate with 1, 4-linkages.

**Chemical Tests**

- 1) **Precipitate Formation with Calcium Chloride:** On adding 0.5% of sample solution in sodium hydroxide with one-fifth of its volume of a 2.5% solution of calcium chloride, a voluminous, gelatinous precipitate is formed. This test distinguishes sodium alginate from gum Arabic, sodium carboxymethyl cellulose, carrageenan, gelatin, gum ghatti, karaya gum, and tragacanth gum.
- 2) **Precipitate Formation with Ammonium Sulphate:** On adding 0.5% sample solution in sodium hydroxide with one-half of its volume of a saturated solution of ammonium sulphate, no precipitate is formed. This test distinguishes sodium alginate from agar, sodium carboxymethyl cellulose, carrageenan, methyl cellulose, and starch.
- 3) **Tests for Alginate:** On moistening 1-5mg of sample with water and further adding 1ml of acidic ferric sulphate, a cherry-red colour develops within 5 minutes which finally turns deep purple.
- 4) On treating 1% sample solution in water with dilute sulphuric acid, a heavy gelatinous precipitate is formed.

**Therapeutic Efficacy**

- 1) Its high and medium viscosity grades are used for preparing pastes, creams, and for thickening and stabilising emulsions.
- 2) It is a good suspending and thickening agent.
- 3) It is used as a binding and disintegrating agent in tablets and lozenges.
- 4) It is used for preparing jellies, ice cream, etc. in food industries.
- 5) It is also used in textile industries.

### 6.1.15. Agar

Agar is a jelly-like substance, obtained from algae, and derived from agarose (polysaccharide), which forms the supporting structure in the cell wall of certain algae species, and which is released on boiling. These algae are known as **agarophytes** belonging to the *Rhodophyta* (red algae) phylum.

#### Synonyms

Agar-agar, Chinese-isinglass, vegetable gelatin, gelose, and Japan-agar.

#### Source

Agar is the dried hydrophilic colloidal polysaccharide complex extracted from the agarocytes of algae belonging to the class *Rhodophyceae*. It is also obtained as the dried gelatinous substance from *Gelidium amansii* and several other species of red algae such as *Gracilaria* and *Pterocladia*, belonging to the family Gelidaceae. The predominant agar-producing genera are *Gelidium*, *Gracilaria*, *Acanthopeltis*, *Ceramium*, and *Pterocladia*.

#### Occurrence and Distribution

These marine plants (**figure 6.5**) grow on the sea bottom and are found along the eastern coast of Asia, the coasts of North America, and Europe. Commercially they are supplied from Japan, Spain, Korea, Portugal, Mexico, New Zealand, South Africa, and the USA. In India, it is found in the Bay of Bengal.

#### Organoleptic Evaluation

- 1) **Colour:** Yellowish-grey or white to nearly colourless.
- 2) **Odour:** Odourless.
- 3) **Taste:** Bland and mucilaginous.
- 4) **Shape:** Strips, sheets, flakes, or coarse powder.
- 5) **Size:** Sheets are 45-60cm long and 10-15cm wide; bands are 4cm wide; strips are 4mm in width.
- 6) **Solubility:** Insoluble in cold water; forms a gelatinous mass after cooling hot solution; soluble in boiling water; insoluble in organic solvents.

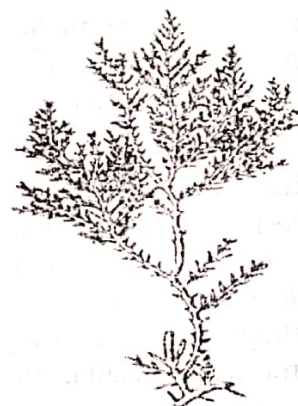
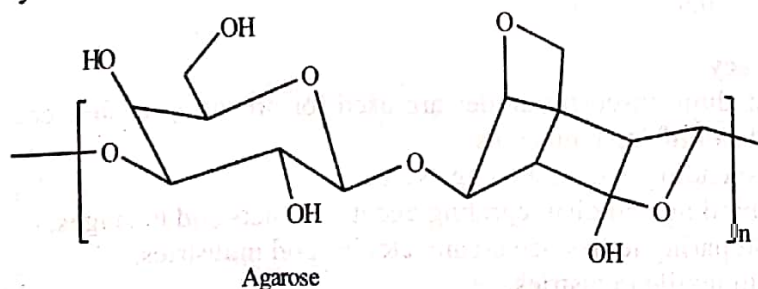


Figure 6.5: *Gelidium amansii*

#### Chemical Constituents

Agar consists of **agarose** and **agaropectin** (polysaccharides). Agarose contains D-galactose and 3.6 anhydro L-galactose units. It also contains cellulose (about 3.5%) and nitrogen containing substances (6%). Agarose is responsible for the gel strength of agar. Agaropectin is a sulphonated polysaccharide in which galactose and uronic acid units are partly esterified with sulphuric acid. It provides viscosity to agar solutions.



### Chemical Tests

- 1) Agar responds positively to Fehling's solution test.
- 2) It responds positively to Molisch test.
- 3) 1% aqueous solution of agar undergoes hydrolysis when heated for 5-10 minutes with concentrated HCl. On adding barium chloride solution to the reaction mixture, a white precipitate of barium sulphate is formed due to the presence of sulphate ions.
- 4) On treating the agar powder with ruthenium red solution, red colour is formed due to the presence of mucilage.
- 5) On warming agar in a solution of KOH, a canary yellow colour develops.
- 6) 1% aqueous solution of agar is prepared in boiling water which on cooling converts into a jelly.
- 7) On adding N/20 iodine solution to agar solution, a deep crimson to brown colour develops (distinctive from acacia gum and tragacanth).
- 8) On adding an aqueous solution of tannic acid to a 0.2% solution of agar, no precipitate is formed due to the absence of gelatin.

### Therapeutic Efficacy

- 1) It is used as an emulsifying agent, bulk laxative, and a suspending agent.
- 2) It is used for preparing bacteriological culture medium.
- 3) It is used in the production of ointments and medicinal encapsulations.
- 4) It is also used as a dental impression mold base.