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Biotechnological importance of sphagnum mosses

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Abstract

Since Belarus is rich in sphagnum bogs it is extremely important to develop ways to use the resources of sphagnum mosses with a number of useful properties. Sphagnum is the only genus in the class Sphagnopsida and includes 36 Bryophyta species in Belarus. Sphagnum mosses, which are widespread in Belarus, have great potential for possible use in contaminated water purification from various hydrophilic and hydrophobic solvents and salt solutions, in light industry and agriculture (considering the need of their renewal).

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Introduction

Since Belarus is rich in sphagnum bogs it is extremely important to develop ways to use the resources of sphagnum mosses with a number of useful properties.

The purpose of our study is to present the potential use of sphagnum mosses in the industrial sector.

Sphagnum is the only genus in the class Sphagnopsida of the division Bryophyta and includes 320 species (1-3). In total, there are 36 Bryophyta species in Belarus (1-3).

Materials and Methods

Sphagnum mosses were studied in the territory of in all provinces of Belarus. The nomenclature follow for mosses to M. Ignatov et al. (2006) (1, 3). Species ecology in respect to humidity and substrate nutrient richness are given according to G. Rykovsky et al. (2009) (2).

Results

Sphagnum mosses are mostly organisms of marshy and wetland areas, growing as compact dense caespitose plants and forming large carpets in sphagnum bogs. Less often sphagnum occurs in wet forests. Soft straight 10-20 cm tall sphagnum stem with bunchy located branches and single-layer sphagnum leaves contain high amounts of hyaline (dead and water-bearing) cells easily absorbing water, resulting in a high-water capacity of sphagnum and a rapid development of raised bogs in places where they grow.

The hyaline cells have pores and perform an active replacement of H^+ ions, which are formed in chlorophyll-containing cells, with the ions from surrounding environment (such as Na^+, Mg^{2+}, Ca^{2+}, K^+ and Zn^{2+}). This substitution effect continues to operate even after the termination of photosynthesis in plants. The hyaline cells structure is maintained after removal of the water, as the cell wall has reinforcing constrictions. Therefore, dried sphagnum plants keep cell structure and absorptivity.

Various species of the Sphagnum genus differ in absorption capacity. Whereas the Sphagnum genus exhibits the highest absorptive power, the Cuspidata genus has the lowest one.

The Sphagnum stems show unlimited tip growth, while its bottom dies out yearly forming peat.

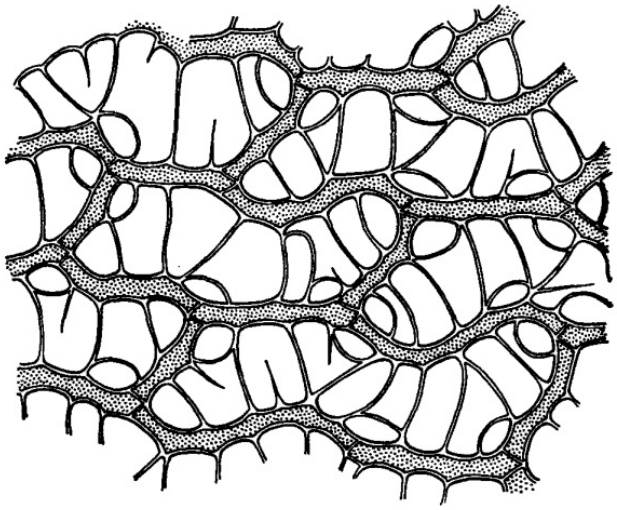

Figure 1. The area of the sheet with the cells of two types.

Discussions

Properties of sphagnum moss. Sphagnum has a high absorbent capacity with respect to liquids, gases and salt solutions (some types of sphagnum moss absorb moisture 20 times its own dry weight). Sphagnum is characterized by antibacterial, disinfectant and antifungal properties (sphagnum is composed of: bactericidal phenol-like substance – sphagnol; antibiotics – sphagnum acid; coumarins, triterpene compounds, etc.). We must also note its ability to moderately acidify the soil by releasing hydrogen ions (pH about 3). The sphagnum moss does not contain nutrients, and therefore is not suitable as a forage reserve in the food chain, and this also prevents the development of saprogenic processes.

The use of sphagnum moss. Live plants of sphagnum moss and peat are used to purify the environment because the sphagnum moss is an excellent absorbent of various hydrophilic and hydrophobic solvents, salt compounds and air pollutants. This method of cleaning is non-toxic, and waste material can be easily destroyed by burning or composting. Plants of sphagnum can also be used as a means of separation of hydrophilic and hydrophobic solutions. Sphagnum has the properties of a hydroponic substrate; it is used as a substrate component in horticulture and floristry as well as in seed germination, cuttings, cloning, and transportation of plants and fruits. The sphagnum moss is used in house construction during log laying. Disinfectants, disposable fluid absorbent products, packaging materials, insoles, shoe items and many more products can be made with the use of sphagnum.

Summarizing the above stated, it should be stressed that sphagnum mosses, which are widespread in Belarus, have great potential for possible use in contaminated water purification from various hydrophilic and hydrophobic solvents and salt solutions, in light industry and agriculture (considering the need of their renewal).

References

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