

FALLEN LEAVES AS RENEWABLE SOURCE FOR PAPER PRODUCTION

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Introduction

In connection with the worsening issues of environmental safety, economical use and restoration of natural resources. Taking the growing volumes of paper manufacture into account, it is possible to use fallen leaves instead of wood in the pulp and paper industry. For most world countries, the alternative to wood is a by-product of the seasonal cycle - fallen leaves. The main substance in fallen leaves is cellulose (about 60-80%), which according to a certain technology can be extracted and used in domestic manufacture, as a substitute for wood and cotton cellulose. Up to this day fallen leaves have been a little used raw material, because it is often burned, and more rarely, turned into compost. Purpose of the study was to extract microfibrils of cellulose from leaves in the process of leaf mass delignification by cooking and to manufacture paper from the obtained cellulose.

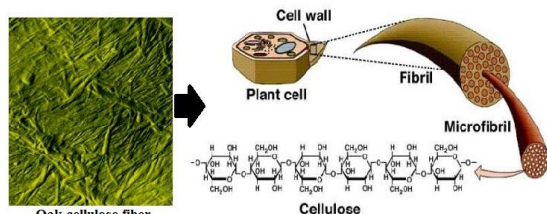


Fig.1. Cellulose fibers in the leaf

Experiments and observation

Experiments were carried out in 3 main stages, which were based on the study of the chemical composition of fallen leaves, the separation of cellulose and the manufacture of paper. Spectral photometry and atomic absorption have shown that the chemical composition of fallen leaves varies depending on the age of the leaves and the place where it falls. The content of cellulose varies within 60-80%. In addition to cellulose, lignin-containing components, hemicellulose, and rosin are found. Ash content varies within 2%. The most volatile experiment was the direct allocation of cellulose by delignification. The most optimal conditions of delignification (the cooking time is 150 minutes, the cooking temperature is 160 degrees Celsius in the alkaline NaOH at a concentration of 50%) is chosen to maintain the environmental friendliness of the method with minimal resource cost. After obtaining cyst of cellulose, a two-stage process of bleaching fibers with hydrogen peroxide (10%) was applied. The logical structure of the process is as follows: leaf harvesting, delignification, waste disposal, bleaching, drying, milling, paper making.

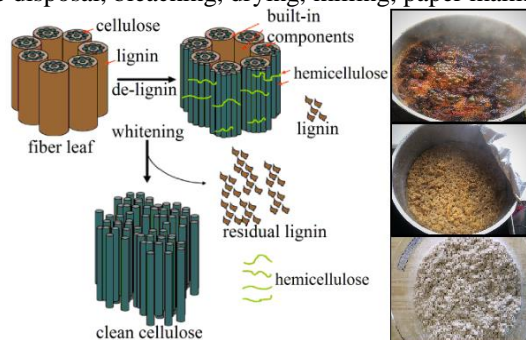


Fig.2. The main processes for the isolation of cellulose

Results

Consequently, as a result of long-term studies, the following can be noted:

1) the chemical composition of fallen leaves has been studied. The possibility of obtaining cellulose for paper manufacturing from fallen leaves with high quality indicators has been shown;

2) the possibility of using agricultural waste – fallen leaves - in the composition of paper products has been experimentally confirmed;

3) it has been established that laboratory samples of packaging paper meet the requirements of the standard;

4) it has been proved that the use of non-wood cellulose makes it possible to exclude more expensive imported cellulose from the composition of mass types of packaging paper.



Fig.3. Paper manufacturing in laboratory



Fig.4. The result of paper making/ The density in this photo is 70 g/m²

Conclusions

Experimentally prove the possibility of using fallen leaves as an alternative to paper manufacturing, which will enable domestic enterprises to use renewable raw materials, expanding their own raw materials base and lowering the cost of finished products. As a result of studies, practical conclusions have been made, an optimized technological scheme for obtaining cellulose for manufacture of paper from fallen leaves has been proposed.

Reference

1. Barbash V.A., Trembus I.V., Shevchenko V.M. Organosolv methods for obtaining fibrous semifinished products from wheat straw / Barbash V.A., Trembus I.V., Shevchenko V.M. // Energy technologies and resource conservation. – 2009. – No. 1. – P. 37-41.
2. Obtaining microcrystalline cellulose from waste products of flax production / Barmin M.I., Hrebenkin A.N., Boiko A.I. [and other] // News of Higher Educational Establishments. Chemistry and chemical technology. – 2004. – V. 47, N3. – P. 156 – 158. – ISSN 0579-2991.