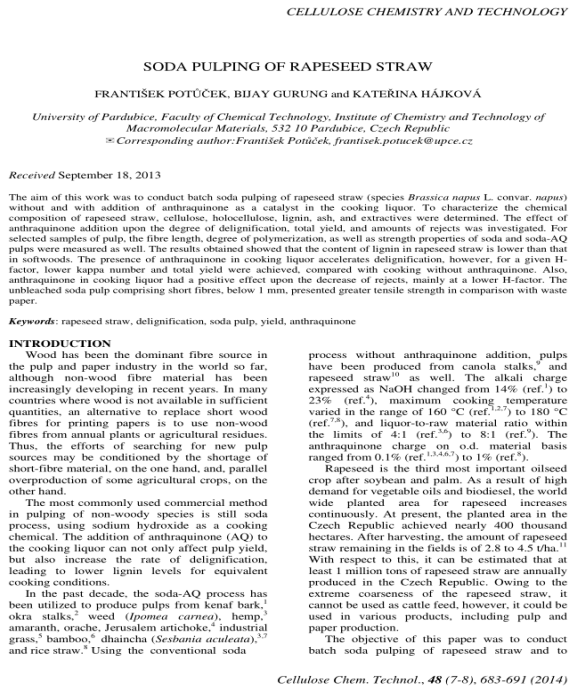
Rapeseed: Chemistry And Technology



CELLULOSE CHEMISTRY AND TECHNOLOGY

SODA PULPING OF RAPESEED STRAW

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The aim of this work was to conduct batch soda pulping of rapeseed straw (species *Brassica napus* L. convar. *napus*) without and with addition of anthraquinone as a catalyst in the cooking liquor. To characterize the chemical composition of rapeseed straw, cellulose, holocellulose, lignin, ash, and extractives were determined. The effect of anthraquinone addition upon the degree of delignification, total yield, and amounts of rejects was investigated. For selected samples of pulp, the fibre length, degree of polymerization, as well as strength properties of soda and soda-AQ pulps were measured as well. The results obtained showed that the content of lignin in rapeseed straw is lower than that in softwoods. The presence of anthraquinone in cooking liquor accelerates delignification, however, for a given H-factor, lower kappa number and total yield were achieved, compared with cooking without anthraquinone. Also, anthraquinone in cooking liquor had a positive effect upon the decrease of rejects, mainly at a lower H-factor. The unbleached soda pulp comprising short fibres, below 1 mm, presented greater tensile strength in comparison with waste paper.

Keywords: rapeseed straw, delignification, soda pulp, yield, anthraquinone

INTRODUCTION

Wood has been the dominant fibre source in the pulp and paper industry in the world so far, although non-wood fibre material has been increasingly developing in recent years. In many countries where wood is not available in sufficient quantities, an alternative to replace short wood fibres for printing papers is to use non-wood fibres from annual plants or agricultural residues. Thus, the efforts of searching for new pulp sources may be conditioned by the shortage of short-fibre material, on the one hand, and, parallel overproduction of some agricultural crops, on the other hand.

The most commonly used commercial method in pulping of non-woody species is still soda process, using sodium hydroxide as a cooking chemical. The addition of anthraquinone (AQ) to the cooking liquor can not only affect pulp yield, but also increase the rate of delignification, leading to lower lignin levels for equivalent cooking conditions.

In the past decade, the soda-AQ process has been utilized to produce pulps from kenaf bark,[1] okra stalks,[2] weed (*Ipomea carnea*), hemp,[3] amaranth, orache, Jerusalem artichoke,[4] industrial grass,[5] bamboo,[6] dhaincha (*Sesbania aculeata*),[3,7] and rice straw.[8] Using the conventional soda process without anthraquinone addition, pulps have been produced from canola stalks,[9] and rapeseed straw[10] as well. The alkali charge expressed as NaOH changed from 14% (ref.[1]) to 23% (ref.[4]), maximum cooking temperature varied in the range of 160 °C (ref.[1,2,7]) to 180 °C (ref.[7,8]), and liquor-to-raw material ratio within the limits of 4:1 (ref.[3,6]) to 8:1 (ref.[5]). The anthraquinone charge on o.d. material basis ranged from 0.1% (ref.[1,3,4,6,7]) to 1% (ref.[8]).

Rapeseed is the third most important oilseed crop after soybean and palm. As a result of high demand for vegetable oils and biodiesel, the world wide planted area for rapeseed increases continuously. At present, the planted area in the Czech Republic achieved nearly 400 thousand hectares. After harvesting, the amount of rapeseed straw remaining in the fields is of 2.8 to 4.5 t/ha.[11] With respect to this, it can be estimated that at least 1 million tons of rapeseed straw are annually produced in the Czech Republic. Owing to the extreme coarseness of the rapeseed straw, it cannot be used as cattle feed, however, it could be used in various products, including pulp and paper production.

The objective of this paper was to conduct batch soda pulping of rapeseed straw and to

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