új berendezéssel jelentős kísérleteket végezetek a szilárdsági jellemzőkre, szakítási értékek szabályozására és az gyártás/keresztirány arányára nézve is. A tanulmányban vizsgálták a rétegszilárdság és a sebesség 400 m/min-re növelésének lehetőségét is.

2001-ben további két lapképző egységet állítottak a Bristol lapképzők helyére, majd később 2004-ben, a többi Bristol lapképzőt is lecserélték 2 Newport Attwood típusra. A gép jelenleg kb. 350 m/min sebességgel működik, de megvan a lehetőség 400-450 m/min sebesség elérésére.

A nemez alatti lapképzők új generációja versenytársa lehet, bizonyos műveletek és termékek esetén, a több síkszitás elrendezésű lapképzőknek és a fölső formeres síkszitás és a Kobayashi rendszereknek.

A több síkszitás papírgépekkel nagy sebesség érhető el pl: a jó minőségű kartonok előállításakor 600 m/min fölött működik. A lapképzők nagy méretűek, nem csak hosszukat, hanem magasságukat tekintve is, ezért költségesek és gyakran nem állíthatók be könnyen egy már létező csarnokba. Létezik több síkszitás papírgép 2, 3, 4 vagy akár 5 síkszitás szakasszal is.

A nyomásos lapképző, melyet ebben a cikkben mutattunk be, szintén használható felső pozicióban (egy már meglévő síkszitás papírgépre építhető).

A fejlesztési munkák még mindig folynak, a jövő igen érdekes fejleményeket tartogathat. Mind a Bristol, mind a Newport Attwood lapképzők a Black Clawson Ltd. gyártmányai.

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Research concerning usage of enzymes to diminish resin content in pulp

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Summary

In the first part of paper negative effects of resin deposition are shown simultaneously with some conventional and non-conventional methods to reduce the amount of deposit.

The experimental part shows the results of trials to diminish the resin content of pulp from fresh spruce chips using CARTAPIP 97 fungi, as well as the results achieved when lipase enzyme RESINASE A 2X was used in the preparation of dissolving and papermaking pulps.

As a conclusion, it is stated that biotechnological treatments are modern, effective and relatively simple methods to reduce resin content in chips and pulps.

Key words: resins, RESINASE A2X lipase enzyme, CARTAPIP 97 fungi, dissolving pulp, papermaking pulp.

Introduction

Manufacture of papermaking pulp and dissolving pulp, mechanical pulp and paper, as well as threads and artificial fibres is disturbed by presence of high resin content.

The composition of resin determines the amount of deposit; its composition is seasonal and wood plant dependent. Thus, the issue of resin deposit occurs mainly during certain months in winter and springtime. Resin that forms deposit always contains high amount of triglycerides. Resin deposition has the following main causes: wood quality, fresh wood proportion, chip storage time, high content of carbonates in recycled water, pH variation, temperature, electric stability of system and degree of water loop closure.

In the field of resin deposit diminishing there exist numerous conventional and non-conventional methods. Conventional methods consist of wood or chip conditioning, removal of fine elements from chips, use of dispersers in the cooking process, use of washing water with a minimum of 40°C, advanced substitution of chlorine with chlorine dioxide and use of dispersers at the papermaking stage (alkali, phosphates, polymetaphosphates, talc, bentonite, surfactants etc.).

Amongst the non-conventional methods the following treatments are mentioned:
- – treatment of chips before cooking with certain fungi;
- – enzyme treatment of pulp.

Biotechnological processes are needed to reduce the resin content and improve the quality of papermaking pulp, mechanical pulp and paper quality, and increase the efficiency of paper machine, as well as in the point of view of the environmental protection.

In this respect, this paper approaches some aspects concerning the possibilities to reduce resin content in fresh chips, dissolving pulp and papermaking pulp using CARTAPIP 97 fungi and RESINASE A2X lipase enzyme.

Materials and methods

To diminish resin content in chips CARTAPIP 97 fungi has been used, the fungi being supplied by CLARIANT-Switzerland and for enzyme treatment of pulp RESINASE A2X lipase was used, delivered by NOVO-NORDISK-Denmark. Main characteristics of CARTAPIP 97 fungi and RESINASE ASX enzyme are illustrated in **Tables 1** and **2**.

Composition	micro-organisms
Activity	20 AU/kg (a unit of activity is enable to inoculate 20 t of fresh chips) AU = 10^{12} viable germs
Solubility	Soluble in any proportion
pH 1% solution	5-7
Moisture	5%

Table 1. Characteristics of CARTAPIP 97

Lipasic activity	109 KLU/g
Colli no.	1
Enzyme nature	lipase
Equivalent name	Lipase, triacilglicerol
IUB no.	3.1.1.3
Enzyme nature	Non-toxic preparation, environmentally friendly, biodegradable
Compatibility	Compatible with H_2O_2, sodium dithionite, $Al_2\ (SO_4)_3$, cationic polymers and talc

Table 2. Characteristics of RESINASE A2X

The activity of RESINASE A2X enzyme depends on temperature and pH (**figure 1**).

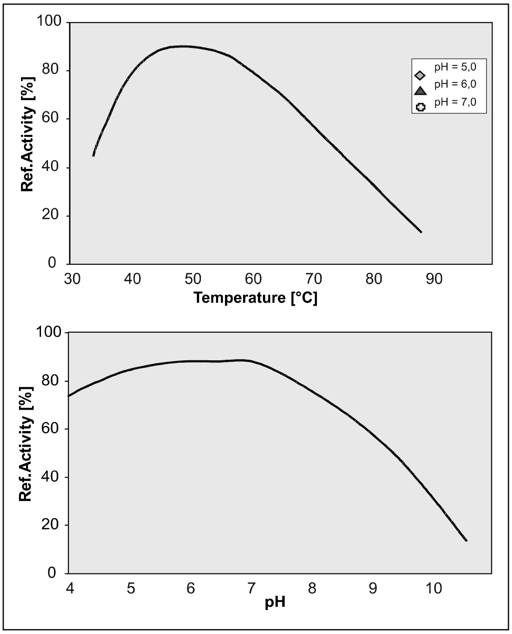

Figure 1. RESINASE A2X activity versus temperature and pH

A unit of lipasic activity is represented by the amount of enzyme that release a titrable micromole of butyric acid/min. under standard conditions (temperature = 30°C, pH = 7.0), emulsifier = acacia gum, layer = tributirine.

CARTAPIP 97 was diluted with water and sprayed upon the fresh spruce chips and the resin content was determined after different storage time of 3; 6; 9; 12 and 15 days. The sprayed product converts into fungi that consume the resinic component of wood. CARTAPIP 97 is similar to a thin mycelium white layer, which prevents development of other fungi that are normally present in chips.

The resin determination has been done with alcohol-benzene extraction (1:2). Our research has proved that a proper pH for enzyme treatment is in the range of 6-7, a very good reduction of resin content is achieved during pulp washing after enzyme treatment.

For dissolving pulp and papermaking pulp (ammonium bisulphate process) the following optimal conditions have been found:

– temperature	45 °C
– time	60 min.
– pH	7.0
– consistency	3 %
– enzyme charge	3 l/t of odt pulp

Results and discussion

Figure 2 shows the reduction of resin content in fresh spruce chips with the storage time using CARTAPIP 97 fungi.

It is clear that after 9 days storage time maximum reduction of resin content of 30% is obtained, additional treatment time being not relevant in this respect.

Besides the resin content reduction, usage of CARTAPIP 97 has also the advantage of wood pore release that allows a faster impregnation with cooking liquor and finally generates higher yield in pulp screening (**figure 3**).

The tested enzymatic process to diminish resin content in pulp consists of usage a lipase

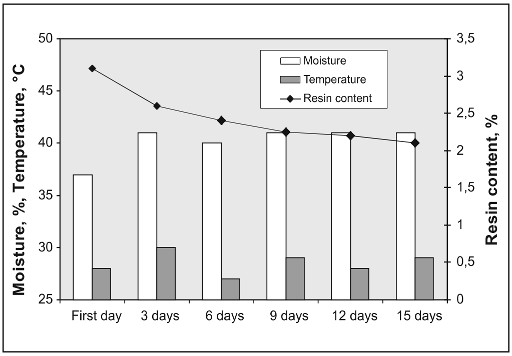

Figure 2. The evolution of resin content in spruce chips treated with CARTAPIP 97

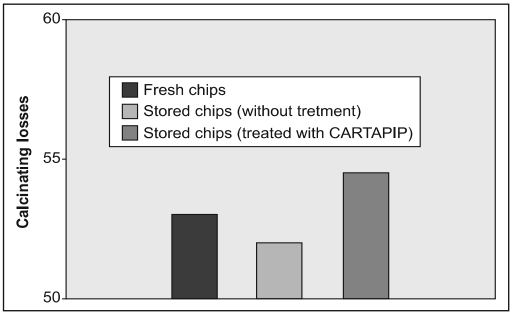

Figure 3. Screened pulp yield in various chip treatment conditions

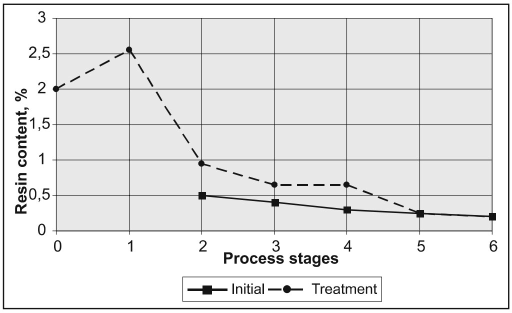

Figure 4. Evolution of resin content during process stages at treatment with Resinase A2X for dissolving pulp (0- wood; 1-sawdust; 2-cooking; 3-washing; 4- upgrading; 5-hypoclorite; 6-end)

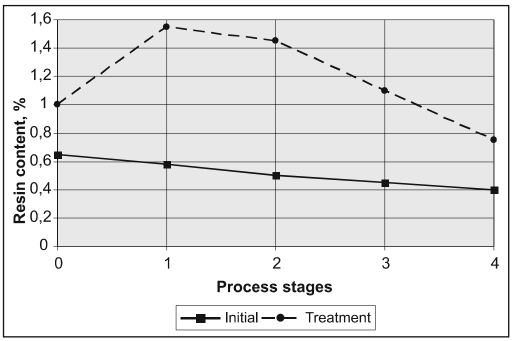

Figure 5. Evolution of resin content during process stages at treatment with Resinase A2X for papermaking pulp (0- washing; 1-chlorination; 2-extraction; 3-hypochlorite 1; 4-hypochlorite 2)

enzyme that hydrolyses triglycerides to fatty acids and removal of fatty acids by saponification with sodium hydroxide. Triglycerides from softwood pulp contain unsaturated fatty acids C16 and C18 for instance palmitic acid, oleic acid and linoleic acid.

Figures 4 and **5** show the evolution of resin content during process stages for dissolving pulp and papermaking pulp.

Figures 4 and 5 notice the following aspects:

– sawdust has the highest resin content and needs advanced screening stage;
– the most suitable pH for an enzyme treatment is pH 6-7;
– for both pulps an average resin content reduction of 50% can be obtained (dissolving pulp with as low as 0.2% resin content can be produced).
– in enzyme treatment increased temperature is not recommended, but the treatment time has major effect.

Conclusions

• maximum decrease of resin content (30%) was obtained after 9 days of storage period, CARTAPIP 97 usage leads to better wood impregnation with cooking liquor, higher yield in pulp screening and bleaching chemical savings;
• CARTAPIP 97 treatment allows to store wood chips for a longer period without colour problems;
• using RESINASE A2X (3 l/odt pulp) about 50% reduction of pulp resin content is noticed;
• to diminish resin content and improve pulp and paper manufacturing processes biotechnologies represent alternative solution.

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Biztonsági papírok mechanikai tulajdonságainak javítása alapanyagok változtatásával*

Kolonics Ottó
Diósgyőri Papírgyár ZRt.

Figyelemmel kísérve a cellulózipart, látszik, hogy fokozatosan nő azon növények sora, melyekből a papíripar számára cellulózt tudnak előállítani, de gazdasági okok miatt egy kissé háttérbe szorul ezen alapanyagok megismerése, esetleges alkalmazása.

Munkám során nagy figyelmet szenteltem a biztonsági papírgyártásra, ahol igen

**Elhangzott a Fiatal Diplomások Fórumán, Budapest, 2005.*