NMP3 - CT - 2004 - 500311

Sustainpack

Innovation and sustainable Development in the Fibre Based Packaging Value Chain

Instrument: **IP**

D 5.33 Report on the recyclability of innovative composites and cushioning materials in the paper recycling stream

Due date of deliverable: 2007-03-31
Actual submission date: 2007-03-28

Start date of project: **2004-06-01** Duration: **4 years**

Stazione Sperimentale Carta, Cartoni e Paste per Carta.

Revision [0]

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Objective: **Evaluation of recyclability in the paper stream of innovative cushioning material**

Introduction- The recyclability issue

In the last years there has been a growing attention towards material recyclability. EU regulations as well as industry and consumers' awarness are pushing the recycling rate of different materials at the highest levels, In the paper and board sector CEPI, along with other organisations have recently set a new objective: enhance the paper recycling rate from the 55.6% reached in 2005 to 66% by 2010. In this framework it is important to address all factors that might influence or even threat the recyclability of paper products, therefore the development of innovative packaging materials.must seriuosly take into account the recycling streams of the end-products.
In this deliverable we have compared some commercially available products with that developed in the project by Oulu University made of fibres and cyclodextrins.

Experimentals.

Cushioning Material

The cushioning material supplied by Oulu University was constituted by dry refined Eucalyptus pulp and 25% Emdex MTW/CC low viscosity dextrin (abbreviation:Eucadex).

Repulping

50 g of material OCC or OCC: cushioning were repulped at 2.5% consitency for 20min (60.000 revolutions) using tap water at 40°C (EN ISO 5263)

Rejects

Rejects were determined by TAPPI T275 sp-02 METHOD using a Sommerville apparatus holding a 150 μm screen.

Sheet adhesion test

Sheet adhesion test was performed on total pulp suspension stock and accept after Sommerville fine screen, according to a modification of PTS-RH 021/97 method[1]**.** Aliquots withdrawn from pulp suspensions stock at 0.5% consistency were used to prepare 2 handsheets (60g/m2) for each sample.

Filtrate assessment

Total fibre suspension diluted at 1% consistency after repulping was initially filtered on 150 μm screen with Shopper Riegler apparatus by free fall dewatering method. Afterwards, the suspension was filtered on 25 μm filter paper before measuring COD. The precipitation of

[1] PTS METHOD PTS-RH 021/97. Testing of raw materials, pulps and additives of paper manufacture.

anionic substances was carried out according to Ingede method 6[2] using Nalco 74508 but the precipitate was recoverd on 12 μm filter paper. Tackiness of the filter (PSS index) was evaluated according to Gable et al. (2006)[3].

Results

The evaluation of recyclability was carried out repulping old corrugated containerboards (OCC) in the presence of 10% of the new cushioning material supplied by Oulu University. For comparison both pure OCC and OCC mixed with the other commercially available cushioning materials were tested under the same experimental conditions.

- Old corrugated containerboard (OCC) 100%
- OCC plus water soluble starch (Naturfill™) 90/10 or 95/5 ratio
- OCC plus Flupis™ 90/10 or 95/5 ratio
- OCC plus Eucadex 90/10 or 95/5 ratio
- OCC plus expanded polystirene (EPS) loosefill 90/10 or 95/5 ratio

After repulping the materials were subjected to laboratory fine screening to determine the potential increase in the amount of pulp rejects. Data reported in Table 1 show that none of the material tested caused an increase of rejects but EPS. The increase of rejects was negligible when OCC were repulped in the presence of starch Naturfill™, Flupis™ and Eucadex. Handsheets prepared after repulping gave unacceptable visual inhomogeneities in the presence of EPS that were still present, although to a smaller extent, even after fine screening at 150μm.

Table 1. Fine rejects assessed at laboratory scale using a Sommerville apparatus with 150μm screener.

	OCC reference	**OCC+ Naturfill™**		**OCC+ Flupis™**		**OCC+ Eucadex**		**OCC+EPS**	
Cushioning, %		5	10	5	10	5	10	5	10
Rejects, %	0.98	1.37	1.26	1.05	1.0	0.89	0.90	2.75	6.43

Sheet adhesion test was performed to asses the presence of disturbing sticky substances both in the pulp suspension and after fine screening (accept). Among all the products tested only Naturfill™ showed an increase of tackiness both on pulp suspension and final accept. Although the level of tackiness was not very high and did not produce visible defects on the handsheets, it must be underlined the increasing the amount of Naturfill™ in the mixture could potentially create recycling problems.

[2] INGEDE Method 6. Precipitation of anionic substances (www.ingede.org)
[3] Gabl H, Hamm U, Bobek B, Putz HJ, Schabel S, Hamann L, Cordier O, Kappen J, Pauly D. Methods used for the measurement of primary and secondary stickies-macro, micro and disco stickies.

Table 2. Influence of cushioning material on sheet adhesion test measured on total fibre suspension after coarse screening

	OCC	**OCC + Naturfill™**	**OCC + Flupis™**	**OCC+ Eucadex**	**OCC+EPS**
Pulper	-	+	-	-	-
Accept	-	+	-	-	-

On the contrary filtrate water was significantly affected by the presence of basically all cushioning products but Eucadex. The data reported in Table 3 show that the presence of 10% of Naturfill™ and Flupis™ resulted in approximately four times increase of COD and 6-10 times increase of precipitate "anionic trash"only COD was slightly increased by Eucadex compared to pure OCC.

Table 3. Influence of 10% cushioning material on filtrate water

	Repulped materials				
	OCC	**OCC+ Naturfill™**	**OCC+ Flupis™**	**OCC+ Eucadex**	**OCC+EPS**
COD (mgO_2/l)	298	1142	1262	474	332
Precipitate (mg/l)	27	150	307	27	57
PSS index	0.27	0.75	3.1	0.20	0.5

Conclusions

The Eucadex cushioning material based on fibre and cyclodextrins shows some clear advantages in terms of its recyclability in the paper stream versus the tested commercially available products. Although, the presence of macrostickies deserve further investigation, the newly development material shows clear advantages on the impact of paper mill water loop related parameters. More specifically, the increase in the amount of disturbing substances and potential secondary stickies is negligible while the release of COD in the water circuit is much lower than the other products.

Issued by: Graziano Elegir
Date: 2007-27-02