

Scientific Report

Short-term scientific mission

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COST-STSM-E48-1217

INTRODUCTION

The mixture of DIP and TMP is seen to lead to an increase in deposition, although the mechanism of their interaction is still unproven and even evidence of their synergetic deposition potential is lacking. Runnability problems will hamper efforts to increase the portion of recycled fibre in paper furnishes, and limits on its usage will always remain artificially low until the technical challenges are solved.

UCM has developed a deposition tester and method which not only measures deposition, but also differentiates between microstickies, which deposit as they are, and secondary stickies, which deposit only after destabilization.

In this study, the scanning analytical method at UCM will be used in conjunction with extraction followed by characterization of the extracts at UCM and ÅA. The two methods will be compared to see how they both measure deposition. Following this, they could be used to help show how the components of TMP and DIP waters can interact and deposit, not only as a total amount of deposition, but also how the microstickies and secondary stickies deposit and how they differ in characterization.

This work is a first step into identifying potential problems regarding the increase in non-paper components in recycled fibre, as seen in these increasing DIP to TMP furnish ratios. It will help determine the limits of DIP, as the possibility of decreased quality exists as world-wide demand for European recycled fibre sources increases. Continuation of this work could reduce the potential negative impacts of the increased non-paper components in paper furnishes, and thus help increase the limits on paper recycling.

METHODS

Pulp from a deinking line was taken from the feed to the preflotation cells, and filtered through a Dynamic Drainage Jar with a 200-mesh wire. The filtrate (1800 ml) was placed into a Rotor Deposition Tester at 50°C under stirring for 60 minutes. A total of 3 tests were carried out on the same sample.

The stainless steel foils of tester were removed and the stickies determined by the scanning method at UCM (*Doctoral Thesis, M. Concepcion Monte Lara, Depositos adherentes en el proceso de fabricacion de papel reciclado, Universidad Complutense de Madrid, Facultad de Ciencias Quimicas, Madrid, 2000*). The foils were then extracted in an ultrasonic bath for 30 minutes first in MTBE, and following drying and an additional scanning, by THF. In each case, the solvent was evaporated in a rotor evaporator and the final extract diluted to an exact volume.

The MTBE-extract was dried and silylated with 80 μ L BSTFA and 40 μ L TMCS for 60 minutes at 50°C before injection into the GC, according to Orsa and Holmbom (*Orsa, F., and Holmbom, B., A convenient method for the determination of wood extractives in papermaking process waters and effluents. Journal of Pulp Paper Science 20 12 (1994), pp. J361–J366*).

The THF-extract was injected into an HPLC system consisting of 2 columns (Jordi 500A), and an ESL detector (Setec 80, 40°C), with THF as the eluent at 0.8 ml/min. An external calibration was carried out with C21:0 and a polystyrene solution.

RESULTS

The determination of the total deposits on 3 foils by scanning is presented as total ppm of deposit and shown in Figure 1 for microstickies and Figure 2 for secondary stickies.

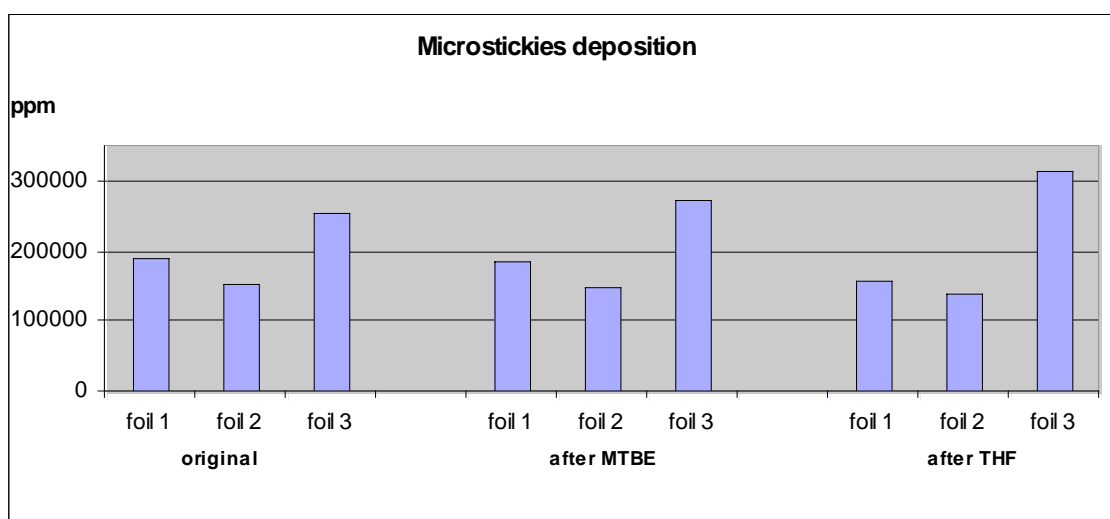


Figure 1 – microstickies by scanning

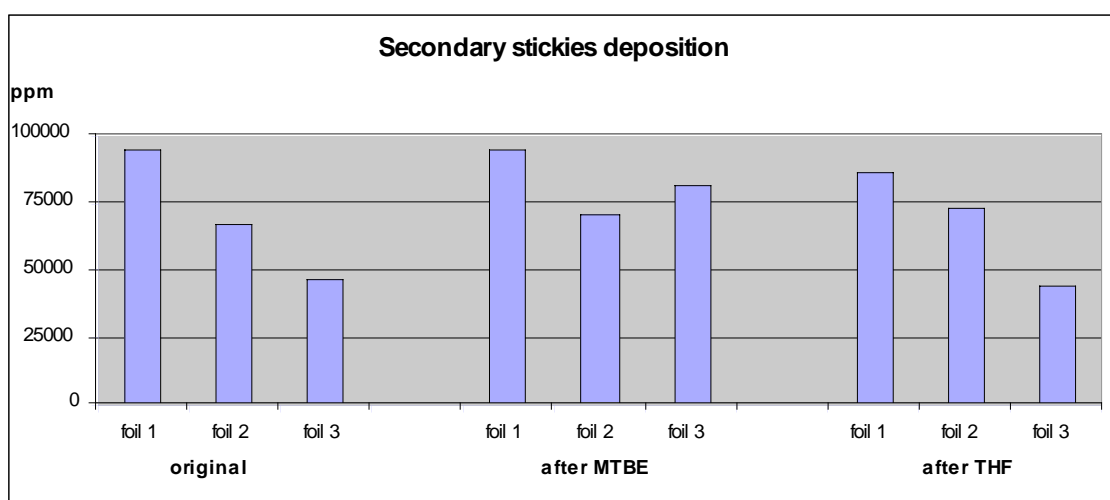


Figure 2 – secondary stickies by scanning

The results of the three scans for each group of foils: the original, post-MTBE extraction, and post-THF extraction, all show equal amounts of deposition. This shows that the wood pitch and other tacky material soluble in MTBE or THF is only a minor part of the total deposit. While the scanning method is suitable for determination of total deposited material, complementary methods, such as extraction followed by analysis with GC or HPLC, are required for identification and quantification of the actual tacky material contained in the deposit.

Due to problems with instrumentation in the beginning of the experimentation phase, the amount of wood extractives to be determined by GC was not possible. Instead, the results for stickies and wood extractives, both micro and secondary, were determined solely by HPLC as described above, and are shown below in Figure 3.

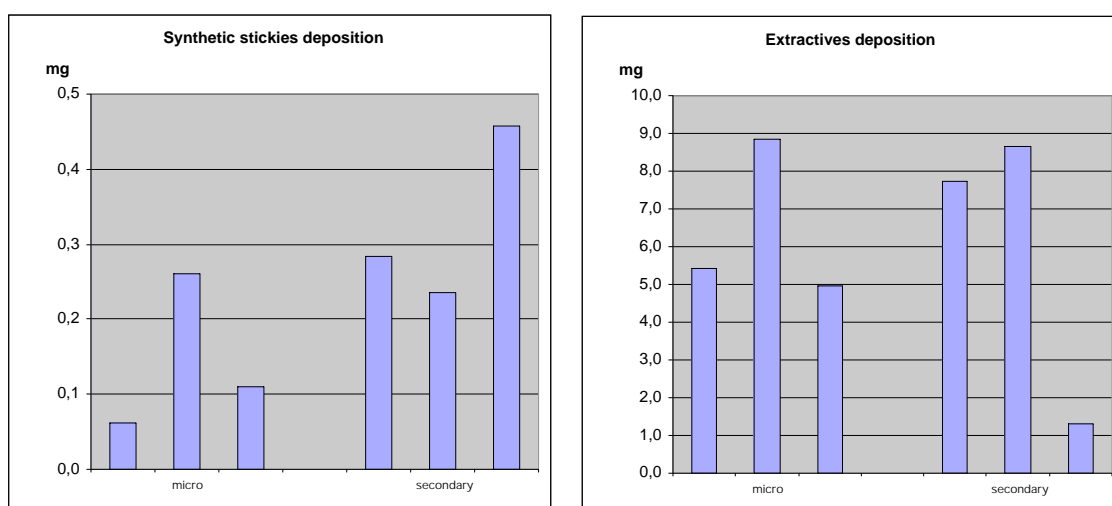


Figure 3 – stickies and extractives deposition for micro and secondary stickies.

In all cases in Figure 3, the variance between the three parallel tests was quite high, but trends are still noticeable. As seen, the deposition of secondary synthetic stickies was higher than the microstickies.

In terms of extractives, both naturally occurring extractives as well as deinking chemicals, one trial had barely any deposition. Otherwise, the amount of deposition for secondary stickies was slightly higher than for microstickies. The amount of extractives compared to synthetic stickies, however, was considerably higher – 10 to 20 times higher. These proportions would not be expected if the components deposited at equal rates. It appears that in these tests, it is mostly wood pitch that deposits, despite being 100% DIP.

RECOMMENDATIONS

The experimentation should be repeated with more trials per sample. Now that the proper amount of standards required for calibration, as well as other method parameters are now known, further experimentation will proceed quickly.

Different mixtures of TMP and DIP can now be mixed, to determine if different mixtures result in more, or less, deposition.

Scanning the foils shows the total deposited material but it does not seem to accurately reflect the extractive or tacky content in the deposits. It is not unreasonable that inorganic material could be making up a large part of the scanned images. Complementary analysis should be performed to more accurately identify the composition of the deposits.

Since the MTBE extraction did not remove all of the extractives, and left quite a large portion, it is recommended that only a THF extraction be carried out. This will save time, solvent, and reduce instrumentation time as only a HPLC system is required.

Further analysis techniques could be employed in the future, such as NIR technology, in conjunction with the existing techniques.