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SNIPPETS
FOR THE PAPER INDUSTRY

Vol.17 / Issue-6 JUNE 2013 www.wirefabrik.com/snippets

FOAM FORMING : A NEW APPROACH TO PAPERMAKING

The use of aqueous foam as a suspending medium for pulp fibers was first proposed by Radvan and Punton from Wiggins Teape Research and Development almost three decades ago. **Foam forming** changes many of the traditional papermaking principles.

The function of a paper machine is to form paper out of pulp. The two most essential elements in papermaking are:-

- ***Fiber :*** While flocculation is the desired property, over flocculation can result in bad formation, two-sidedness and can affect porosity.
- ***Water :*** Considered as the key to papermaking with four essential roles : acts as a suspension medium for the fibers; promotes fiber swelling and binding through hydrogen bonding; acts as a solvent for other papermaking ingredients; imparts an anionic charge to fibers.

In the aqueous media, due to swelling, fibers and fines develop a very high specific surface area. Many wet-end chemistry interactions take place at surfaces, hence components having higher surface area play the major role.

FOAM FORMING

A lower environmental impact, improvements in dewatering, increased forming consistency and reducing costs, has been the approach to develop a more resource efficient process.

In foam forming, a large amount of air is injected into a fiber suspension. The fibers inside the foam are locked between the foam bubbles, and thus do not flock during transportation. This provides better formation and allows the usage of higher consistency stock.

This kind of forming leads to other positive effects, such as better drainage, since the forces affecting fibers during dewatering are smaller compared to water forming. When combining foam forming with air drying, it is possible to make very bulky structures.

Pore size distribution is a key paper property in many processes such as drying, coating, printing etc. With normal water forming operations, it is very difficult to change the characteristic shape of the distribution. The distribution usually has log-normal form, which means that the amount of large pores is relatively small. On the other hand, quite different pore size distribution can be obtained by using foam as the carrier phase instead of water.

In sheets made with foam forming, there are more large pores compared to water formed sheets. The pore size is affected by the size of the bubbles in the foam. However, overall, pore size distribution is also affected by the fiber type.

The effect of several parameters such as rotor speed and foam density together with the type and concentration of surfactant have been investigated in order to determine how to control bubble size. The bubble size distribution has been compared to the amount and size of bigger pores in paper samples prepared with various kinds of foams and fibers. Results clearly indicate that pore size distribution of paper made with foam forming depends on properties of foam. This enables a more flexible tuning of pore-size distribution than in the case of water forming.

THE MECHANISM

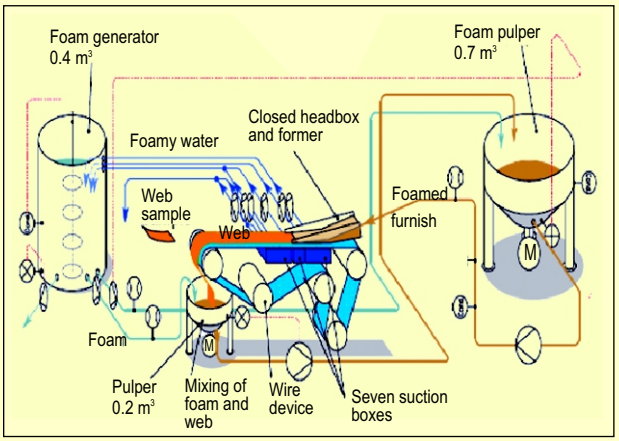

Fig 1 : SUORA Pilot Scale Schematic Diagram

Foam is a dispersal system consisting of gas bubbles separated by liquid.

The relative proportion of liquid and gas determines whether the foam is “wet” or “dry”. There is no exact boundary between these two regimes, but generally speaking, in the case of gas content below 80% the flow of foam resembles that of liquid and the foam can be called “wet”. Air content, bubble size distribution and half life time are three basic measurements used for characterization of foams and surface active agents.

The foam forming process consists essentially of mixing an aqueous slurry of fibers at a consistency in the range of 0.5 to 7

INDUSTRY NEWS	**MeadWestvaco Corpn**., global leaders in the packaging industry, have signed a MOU with the Gujarat Govt. committing an investment of more than Rs 1000 Crores for installation and upgradation of facilities related to production of packaging paper and board. This signals their confidence in the future of the Indian Packaging market.

percent with sufficient aqueous foam containing a surfactant and having an air content in the range of 55 to 80 percent by volume to give a foamed fiber furnish containing approximately 0.1 to 3 percent fibers by weight.

This is supplied directly to the forming wire of a twin wire papermaking machine, adding makeup surfactant and discarding excess aqueous foam from the process as required, to maintain the desired volume of foamed liquid.

Generally we consider wet foams with 77% air where the bubble shape is quite spherical and there is no direct contact between the bubbles. In order to have meta-stable foams, a foaming agent such as a surfactant is needed. At low concentrations, the surfactants adsorbs onto the air-water interfaces, altering the free energies of the surfaces.

The process allows the handling of long fibered stocks. Since the fibers are suspended in foam, the dispersion of these long fibers even under high shear conditions at consistencies of 0.5 to 1.5% gives excellent paper formation.

Overall the process yields paper with a high level of bulk, softness and porosity.

CURRENT DEVELOPMENTS

VTT Technical Research Centre of Finland together with several industrial companies has built a new pilot scale technology platform for foam forming applications.

The Centre is equipped with a small scale wet end simulator and web forming arrangement where both conventional papermaking and foam forming experiments can be carried out. *(see Fig 1).* The principle of this process is to recirculate the foam and to mix the fibers in a pulper. The maximum running speed for foam forming is 300 m / min.

SUORA is a pilot-scale research facility for fiber processes, developed in close collaboration with the members of Forestcluster Ltd.

Already, good quality paper and board samples from 23 gsm to 140 gsm with speeds up to 400 m / min have been produced in *SUORA* using foam forming technology.

Test samples have been prepared from softwood kraft pulp, spruce CTMP, PCC and nanofibrillated cellulose. Some of the products produced are bulky, porous and moldable and can be used in construction, packaging, insulation, etc.

With foam forming it is possible to achieve very high bulk values (6 to 10 dm 3 / kg) and thickness of upto 60 mm and also control the values by using products such as nanocellulose as a strength agent.

CONCLUSION

Foam forming will lead to new manufacturing platforms for fiber based products as it.

- Results in significant fiber savings, much lower water needs, less drying energy, reduced chemical costs.
- Enables production of very even and high porosity structures from less valuable materials.
- Enables exploitation of new raw material combinations - including nanocellulose (NFC).
- Enables development of novel products having high thermal conductivity.
- Offers a sustainable solution to manufacture a wide range of products such as paper, board, tissue, hygiene products, insulation materials, filters and other added value products from bio-based, long fibers.

QUOTABLE QUOTE	***Someone else doesn't have to be wrong for you to be right.*** *- Anon*
SCRABBLE	What does **D P S** stand for? (Hint : Forming Fabric) First correct answer will win a Parker Vector Roller Pen (Maximum two prizes for one person in a year). Email your answers to snippets@wirefabrik.com by 20th June, 2013.
WINNER MAY'13	**Mr. P. Nanda, Jr. Mgr. (R&D), Emami Paper Mills Ltd.,** Village Balgopalpur, PO Rasulpur, Dist. Balasore, Orissa-756020 **Answer :** **APPITA** : Technical Association of the Australian and New Zealand Pulp and Paper Industry
?QUIZ	**Check the right options** **a) All surfactants are soap / not soap.** **b) Coagulation occurs through polymer bridging / charge neutralization.** **c) Soft / Hard water is required in flotation de-inking process.** **d) Foam is caused by entrained / dissolved air.** Email your answers to snippets@wirefabrik.com by 20th June, 2013.
WINNER MAY'13	**Mr. S. Kannan, Dy. Manager-PM#5 (O), ITC Ltd. PSPD,** Vill. : Sarapaka, Burgampad Taluk, Dist. Khammam, AP-507128 **Quiz :** Match the members of the two groups a) Turbidity b) Conductivity c) Charge Density d) Tint 1) Hazen 2) Meq. Per Litre 3) FTU 4) Microsiemens Per Second **Answer :** a) = 3) ; b) = 4) ; c) = 2) ; d) = 1)
Prizes	**1. Best / first correct answer** received will win one-year subscription to **IPPTA Journal** *(Maximum one prize for one person in a year).* **2. Best of the 12 monthly winners** in a year, will win one-year subscription to **Paper 360° Magazine, USA.**
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Published by >>	**Wires & Fabriks (S.A.) Ltd, JAIPUR-302012,** India.	***Phone: +91-141-2341722 Fax: +91-141-2340078*** ***Email: snippets@wirefabrik.com***	*Only For Private Circulation*

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