

Increasing the Absorbency

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High-quality tissue paper is today produced using TAD (through-air-drying) technology, which is widely established as the most efficient drying method to increase bulk and softness in commercial tissue production. In the TAD process, it is essential to ensure uniform temperature distribution in the stream of drying air in order to achieve superior quality in terms of the softness and absorption capacity of the product. Sulzer Chemtech's SMV mixing elements create even temperature profiles very efficiently and at low pressure drops.

▶ In traditional tissue making, a flat sheet is dry-creped and embossed. Creping is the process of crinkling a sheet of paper to increase its softness. In a TAD system, the pressing procedure is eliminated, thus reducing web compaction. TAD technology removes water by passing high-temperature air through the sheet. A TAD sheet has up to 75% more bulk than a conventional dry-crepe sheet. In paper making, bulk is the reverse of density and describes the fluffiness of the material.

Increase in Toweling Capacity

The most striking effect of TAD is that it increases the tissue's capac-

ity to hold water. Unlike pressing, TAD does not change the 3-dimensional web of irregularly intervening cellulose fibers and freezes the shape between them. When the tissue gets wet during use, the sheet retains its void volumes and does not collapse. The effect on toweling is particularly dramatic. A TAD towel can hold up to 16 times its own weight in water, which is twice the capacity of a conventional dry-crepe paper towel (Fig. 1).

Stream Quality is Essential

The properties of the hot air stream that is passed through the sheet for drying influences the quality of the product. Uniform drying time for the web provides



1 High-quality tissue can hold a multiple of its weight in water and has a soft texture. Sulzer Chemtech technology supports the tissue-drying process which significantly enhances the quality of this product.

the product with uniform characteristics, thus improving its feel and performance. To achieve a uniform drying time, the temperature distribution in the drying stream has to be even (Fig. 2). In addition, the heat generated by the burners is used more efficiently, resulting in a reduction in the system's energy consumption.

In 2005, Sulzer Chemtech delivered mixing elements for the air stream in the TAD system of a tissue machine supplied to the Chinese market. China's tissue industry is growing at a rate of 5–7% p.a., with an anticipated production volume of 4.1 million t in 2010. Global tissue production totaled around 20 million t in 2005. Sulzer Chemtech's SMV static-mixing element operates very efficiently in temperature homoge-

nization applications (Fig. 3). The low pressure drop and small mixing eddies created by the SMV element make it a superior choice for mixing gas streams of dissimilar temperature.

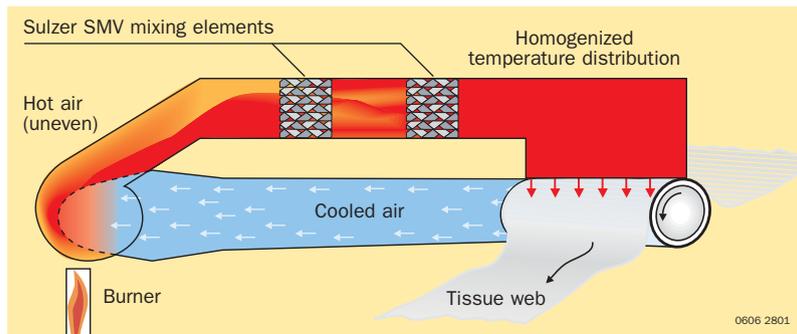
Requirements Exceeded

The customer needed to reduce the temperature variation in a hot air stream of around $94 \text{ m}^3/\text{s}$ from $204 \pm 8^\circ\text{C}$ to $204 \pm 1^\circ\text{C}$ in a rectangular duct of $2396 \times 2026 \text{ mm}$. The system provided a mixing distance of 8 m, and the available pressure drop was around 750 Pa.

An estimate by Sulzer Chemtech indicated that by using a suitable configuration of different SMV mixing elements, the temperature variation could be reduced by a factor of more than 10 between the inlet and outlet. This value allowed for a reduction in the deviation from 8°C at the inlet of the mixing elements to less than 1°C in the drying stream—a result that exceeded the customer's requirement by some 20%.

An 8-layer SMV element with special orientation was placed upstream to mix in the short direction of the duct. The second SMV element of another configuration was mounted around 4 m downstream to mix in the axial direction. Both

2 In a TAD (through-air-drying) system, a stream of hot air is forced through the wet tissue web.



3 The Sulzer Chemtech SMV gas mixer creates low pressure drop and delivers an excellent mixing performance.

elements were composed of materials that were suitable for the application.

Higher Deviation Possible

The customer chose this arrangement in order to use as much of the available pressure drop as possible. Optimal mixing was achieved while fulfilling the tight pressure drop requirement by carefully selecting and arranging SMV geometries with complementary mixing effects. With the chosen arrangement and the desired deviation of $\pm 1^\circ\text{C}$ in the drying stream, the temperature in the air stream coming from the burners could even vary by $\pm 10^\circ\text{C}$, and the Sulzer Chemtech mixers would still meet the customer's requirement. ◀

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