ENERGY SAVERS

INTRODUCTION

What your microwave oven did for your kitchen, radio-frequency drying can do for your process. Radio-frequency (RF) drying is increasing in popularity in the textile industry because it is fast, effective, and economical.

This bulletin will review the benefits of using RF to dry yarn packages. RF dryers can also dry most other textile products, including loose stock, hanks, muffs, cones, tops, bumps, tubular knits, and hosiery.

WHAT IS RADIO-FREQUENCY DRYING?

Radio-frequency drying uses radio waves to evaporate water from some other material—in this case, yarn packages. In the same way that a microwave oven cooks food by heating the water molecules in the food, radio waves dry a yarn package by heating the water molecules within the package. Radio waves do not significantly heat the yarn molecules in the package, so the yarn cannot be overdried as easily as with conventional convective heating. The rate of RF drying depends on moisture content, which means that the wettest areas dry faster than less wet areas, resulting in uniform final moisture content.

The package drying process benefits in a number of ways from the fact that the radio waves act mainly on water molecules.

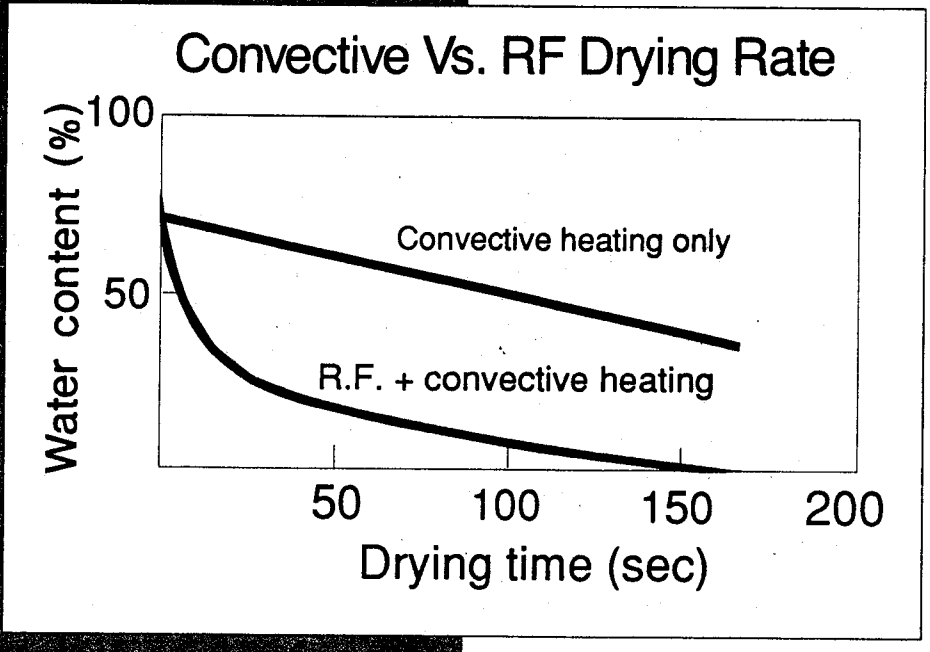


Figure 1. See footnote 2.

BENEFITS OF RF PACKAGE DRYING

Quality

RF drying results in excellent shade and hand. With conventional forced-air drying, the outside of the package is often overdried, resulting in color streaks and a harsh hand. Forced-air drying can also distort package shapes. With radio-frequency drying, energy is concentrated on the

wettest parts of the package so the outside of the package does not overdry. Steam escaping from the inside of the package swells the fibers, improving the hand. Because no air is forced into the packages, they retain their shape.

Uniform Drying

With conventional drying methods, it is difficult to achieve a uniform moisture content in and among packages. In an RF dryer, final moisture content within a package can be controlled within plus or minus one percent after hydro-extraction[1]. Also, packages of different moisture content can be dried at the same time in an RF dryer. Because the wettest packages dry fastest, they will tend to "catch up" to the packages that started out less wet. (However, drastic differences in moisture levels cannot be corrected in an RF dryer.)

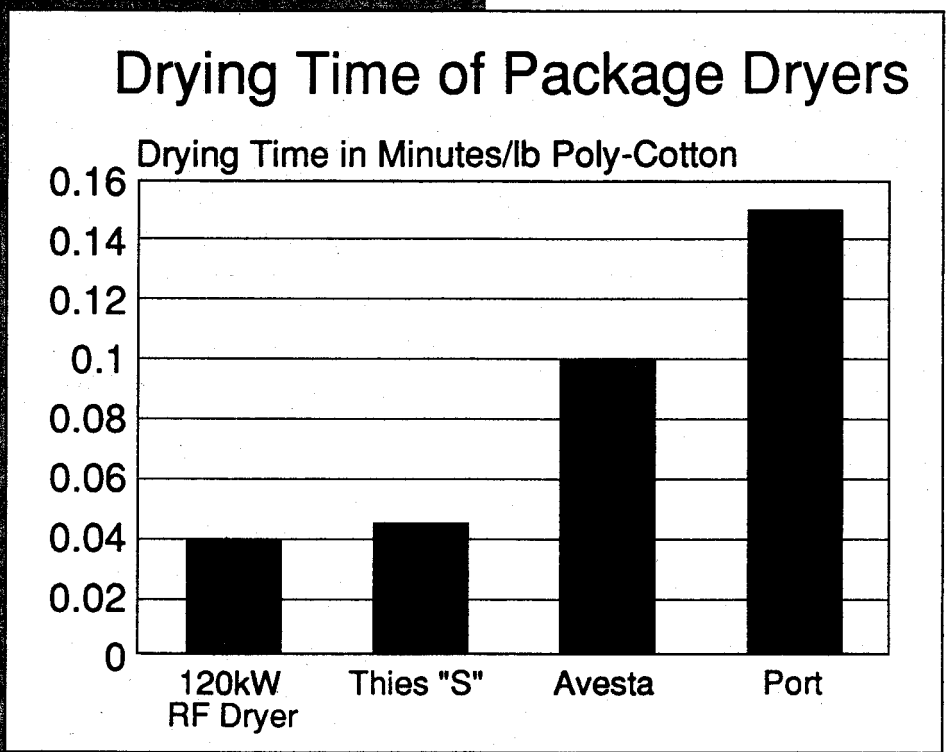
Figure 1 shows the difference in drying characteristics between convective and RF drying. The convective drying rate is linear over the initial drying period while the RF curve asymptotically approaches zero moisture as drying proceeds. In other words, the wetter the package, the faster the rate of drying.

Just-in-Time Processing

One company decreased batch time for drying rayon 20 hours by installing a radio-frequency dryer. Previously, the process called for yarn packages to be hydro-extracted down to a moisture content of 65 percent and then loaded onto large metal pin frames and rolled into steam-heated ovens. The packages were baked for 32 hours to reduce the moisture content to approximately 10 percent.

Now the baking time has been reduced 11 hours, to obtain a moisture content of 20 percent. After baking, the packages spend 45 minutes in the RF dryer to reduce the moisture content to 8 percent, at a rate of 1650 pounds of yarn per hour.

As seen in Figure 2, radio waves dry packages faster than a variety of other dryers. For customers processing



small lots, RF dryers save even more time because lots with different colors can be dried together.

Versatility

RF dryers can successfully dry a wide variety of shades— from pastel to dark. They can also dry a wide variety of fibers, including nylon, acrylic, cotton, spandex, rubber (in elastic bands) and blends. Also, wet shipments of yarn can be dried on the cone in an RF dryer without having to be rewound.

Good Working Conditions

RF dryers give off no fumes or gases, little noise, and are cool to the touch. Steam from the processed goods is vented outside the plant, so it does not affect indoor air temperature. Conventional convective heaters produce emissions when dyes and other chemicals are heated while the packages are drying; because radio waves heat only the water, these emissions are reduced in a radio-frequency dryer. Furthermore, because air is not forced into the packages, the working environment is kept clean of lint.

Operator Safety

RF dryers are as safe or safer than conventional dryers. Special shields on the machine keep the operator from being exposed to harmful levels of radio frequency. Safety devices built into the dryer prevent access to potentially dangerous places in the dryer where the high intensity field between electrodes could burn flesh. Radio waves do not produce any long-term changes in the human body.

Low Production Costs

When RF drying is preceded by centrifugal extraction, drying costs are comparable to pressure dryers and cheaper than port dryers and oven dryers. A study by the Institute of Textile Technology reported that at $3.50 per 1000 pounds steam and $0.05 per kilowatt-hour, the energy cost to dry 50/50 polyester/cotton yarn packages was $0.036 per pound of yarn in a port dryer, $0.019 per pound of yarn in a Avesta

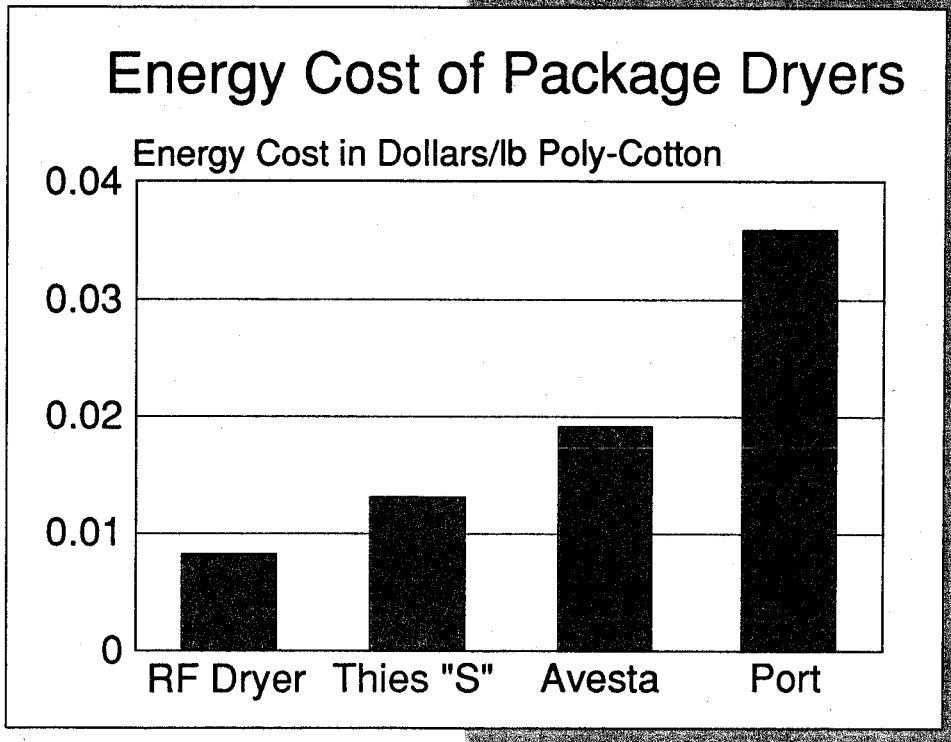


Figure 3. See footnote 2.

dryer, $0.0113 per pound of yarn in a Thies Type "S" dryer, and $0.008 per pound of yarn in an RF dryer. Figure 3 shows this comparison of various yarn package dryers. Depending on the operation and layout of the RF dryer, it may require extra labor cost when used in tandem with a centrifuge.

Low Maintenance Costs

RF dryers require much less maintenance than conventional dryers. Less than two hours per week is enough for cleaning the filters and checking the cooling system. Conventional systems require an average of more than four hours of maintenance per week.

SUMMARY

Radio-frequency drying is a fast, effective, and economical way to dry yarn packages. It has a number of process and quality benefits because it heats only water, not yarn. In addition to improving and speeding up the process, it is safe, clean, and versatile.

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SUPPLEMENTARY RESOURCES

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