

# A Second Life for Wastepaper

By Shigeo Egusa

Once a piece of paper has been used for its original purpose, its very name is transformed in Japanese from "*kami*" to "*koshi*" (wastepaper). But a new name does not change the fact that it remains paper. "Today's news is over. But newspaper is alive" is the ad slogan used in the U.S. to encourage the collection of old newspapers. The message is on the mark: newspapers can be recycled to have new life.

Japan has a long history of paper recycling, dating back to the Heian Period (794-1192). In those days, the "*Kan'ya-in*," a government-operated paper factory, made paper using scrap paper from calligraphy and painting practice as raw material. For centuries, paper soiled with India ink was regenerated by repeated washing and rinsing. It, too, had a name. Because pale black spots remained after the washing, it was called "*usuzumi-gami*" (pale black paper), or "*sui'un-gami*" (water-cloud paper).

Thanks to advances in paper recycling technology, re-manufactured paper today is used not only for cardboard and newsprint but also as high-quality white art paper for posters, calendars, catalogs, and magazine gravure pages. The extensive use of recycled paper has been made possible by technical tie-ups between Japanese and foreign machine builders, business links between domestic machinery manufacturers and paper-manufacturing firms, and independent research and development by Japan's paper makers themselves.

The recovery ratio rose by more than 10% after the first oil crisis in 1973, and had reached 50.7% by fiscal 1984. This is the second highest ratio in the world, only after that of Hong Kong. Japan is an honor student as far as paper recovery is concerned. Its high recovery rate, which is close to the maximum possible, reflects excellent wastepaper recovery and recycling systems.

One of the merits of wastepaper is that it brings down the cost of pulp. In addition to conserving energy, of which more later, enormous savings can be achieved in construction costs. A plant to make

pulp from wastepaper is only half to one-fifth as expensive as a machine- or chemically-treated pulp manufacturing plant. A second merit of using wastepaper is that it helps conserve and protect forest land. Wastepaper is often called the "urban forest," and it is truly as precious as natural forest land. In developing countries, poverty and rapid population growth have invited the destruction of woods and forests for farmland and firewood. In advanced countries, forests are being destroyed by acid rain as the mass consumption of energy exacerbates air pollution. With such gloomy prospects worldwide for forest land, it becomes even more urgent to make better use of the "urban forest." Among its many other merits, recycling paper can even alleviate air pollution.

## Origin of wastepaper and recycling

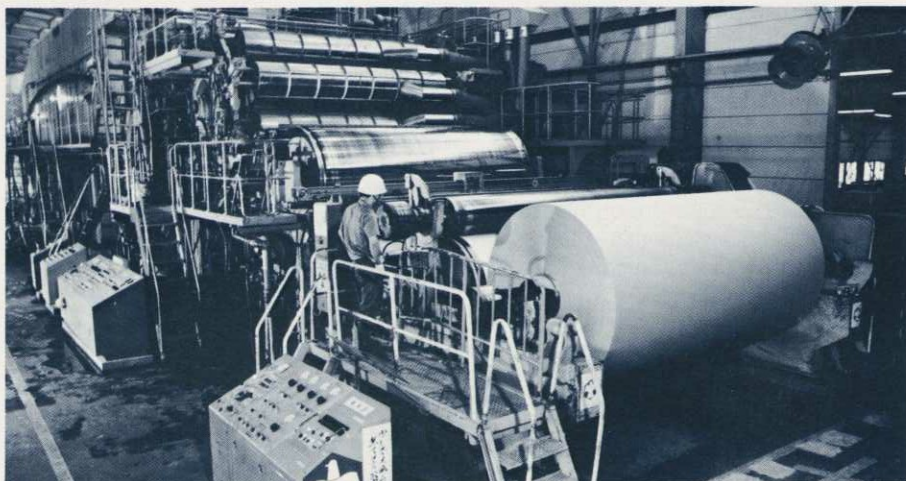
"Where there are people, there is paper." Places where people live and work are the places where wastepaper is generated. The sources of old newspapers, magazines, and corrugated cardboard are homes, department stores, supermarkets, businesses, and government offices. Publishing companies, printing and bookbinding plants, box and bag factories as well as cutting and processing factories produce corrugated cardboard

scrap, cut-off pieces of newsprint and books, soiled paper, and leftover sheets. What are the channels for efficiently recovering this paper and transporting it to paper mills? Who collects wastepaper? Fig.1 briefly sets out all the channels used for this purpose in Japan.

Of all wastepaper originating in homes, old newspapers are by far the greatest in volume. They are collected by wastepaper collectors who make the rounds of residential areas in light trucks or with wheeled carts, and take old newspapers in exchange for tissue paper or toilet rolls. There are also so-called collective recovery systems, under which community organizations like the Boy Scouts, town associations, women's associations, and the PTA bring wastepaper regularly to designated collection points. Wastepaper thus collected is sold to professional collectors, including wholesale rag dealers, direct delivery agents, and the neighborhood collectors mentioned earlier. The business of exchanging wastepaper for toilet rolls started around 1965, and the collective recovery system about 1972.

Purchasers of wastepaper are affiliated with wholesale rag dealers who purchase rags and junk daily. Because wastepaper purchasers collect other discarded items as well, they sort out what they have gathered during the day and sell it to the wholesaler specializing in each category.

The huge quantities of wastepaper and

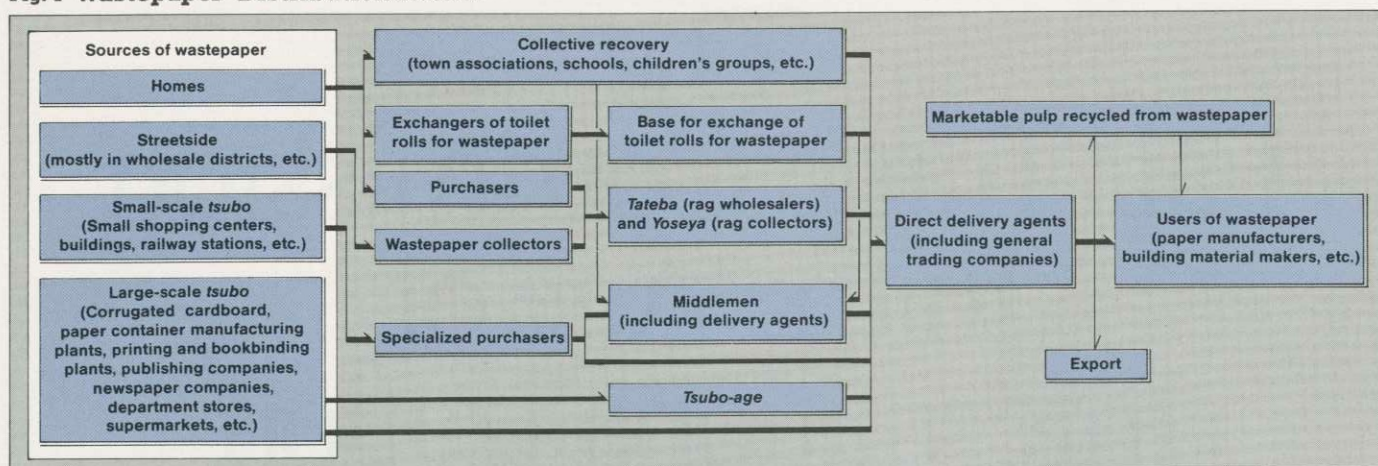


The miracle of recycling: put in newsprint and out comes high-quality white art paper.

Shigeo Egusa is an engineer at the Technology Environment Division of the Japan Paper Association.



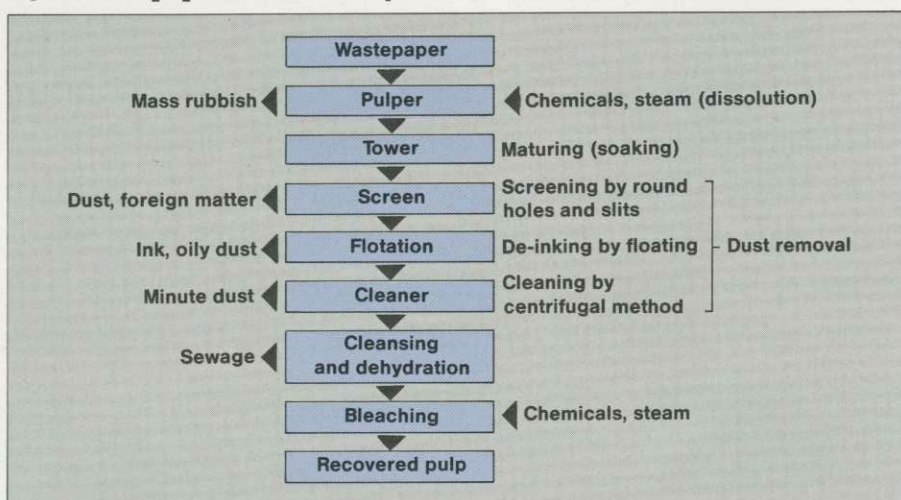
Fig. 1 Wastepaper Distribution Routes



paper scrap originating at printing and bookbinding plants and other paper-processing facilities are called industrial wastepaper, and the plants themselves are known in the business as *tsubo*. Dealers who collect paper from *tsubo* are called *tsubo-age*. They collect good-quality wastepaper, unused newsprint, cut-off corrugated cardboard pieces, and unsold magazines returned to publishers.

Specialized purchasers are similar to *tsubo-age*, but they collect wastepaper primarily from supermarkets, department stores, vegetable and fruit shops, and other retailers. Yet while collection channels vary, in the end all recovered wastepaper is delivered to paper-manufacturing companies via direct delivery agents.

Fig. 2 Wastepaper Treatment System



dust removal, and de-inking. Unless all three are carefully coordinated, fine quality pulp cannot be obtained.

## Resource and energy conservation

If Japan did not recycle wastepaper, how much forest land would it lose? Computation based on data furnished by the Wastepaper Recycling Promotion Center finds the following.

To produce one ton of paper made of 50% chemically-treated pulp and 50% mechanical pulp requires 2.4 cubic meters of timber. An eight-meter tall tree with an upper diameter of 10cm and a lower diameter of 17cm yields 0.12 cubic meters, so 20 such trees are needed to manufacture a ton of paper. In fiscal 1984, approximately 9.8 million tons of wastepaper were recycled, equivalent to 23.5 million cubic meters of timber, or about 1% of Japan's forests. In terms of acreage, the 23.5 million cubic meters of trees conserved equal 235,000 hectares (2,350 million square meters) of forest land.

Consumption of pulp wood in 1984 reached approximately 31 million cubic meters, broken down into 18.7 million cubic meters of domestic pulp wood and 12.3 million cubic meters of imported pulp wood. Wastepaper recycled in 1984 was equivalent to 75% of all the pulp wood consumed during the year. Pulp recycled from wastepaper amounted to about 43% of total consumption of paper-making fiber.

How is this reflected in energy consumption? According to Recycling Promotion Center data, it takes the equivalent of 80 liters of fuel oil to manufacture one ton of pulp from wastepaper, whereas 250 liters would be needed to produce a ton of paper from a fifty-fifty mix of chemically-treated and mechanical pulp.

Calculating on the basis of these figures, the amount of wastepaper consumed in fiscal 1984 was equivalent to some 1.7 million kiloliters of fuel oil, or 38% of the fuel oil consumed annually by the paper/pulp industry. Clearly, given all its many merits to society, recycled paper is truly worth its weight in gold. ●

## Wastepaper recycling technology

"Wastepaper" encompasses printed paper, processed paper, paper boxes, and paper bags recovered after serving their original purposes. Recycling wastepaper therefore necessitates removing anything originally applied to the paper fiber for specific purposes. This in turn requires technology for separating non-fiber substances from paper fiber, and reducing the fiber into pulp. Fig.2 shows a typical treatment system. A machine called a pulper and resembling a mammoth washing machine dissolves the wastepaper into fiber (dissolution), removes dirt, dust and foreign matter from the dissolved fiber (dirt removal), and extracts printing ink (de-inking). The dissolved substance is placed in a centrifugal cleaner which removes minute dust by utilizing differences in specific gravity, and is then cleansed and bleached before being finally recovered into pulp. Wastepaper processing thus involves three processes: dissolution, dirt and