Paper Vs. Plastic Bags?

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We've all been in the grocery store, at one time or another, and been asked, "Paper or plastic?" Do you remember which you chose? Moreover, why did you make that particular choice? And, was it an informed decision?

In our era of ecological and environmental awakening, the question of paper or plastic bags should be taken, and considered seriously. Everyone uses bags; Everybody has this choice. Why do we have a choice? It is a question of environmental impact, and it should be the responsibility of us all to make the most ecologically aware, and sound decision.

This homepage is an exploration of, and an attempt to answer, the question of which, indeed, is the better choice, paper or plastic bags?

Where it comes from: Paper.

Paper comes from trees, and the pulpwood tree industry is large. It begins with logging, where select trees are found, marked, and felled. After they're cut, roads are built into the forest on which the large machinery, used to load and transport the timber, can be moved. This process creates a tremendous scar in the forests natural habitat(s), for both plant and animal. It can take over a century for nature to recover from even a small logging operation. Addedly, if the small operation clears only 10 acres, many hundreds of acres surrounding are affected due to the extreme interplay/interdependency in nature.

Let it be added further that a large amount of heavy machinery is used, all having its own story on how it came to be, all needing its own upkeep, and all needing its own fossil fuel, to operate. On top of this, there is the human element. Logging is dangerous. Extreme fatigue, long term physical handicaps, and numerous accidents plague the less-than-wealthy loggers.

Logs are moved from the forest to a mill. Whence they reach a mill, there is a three year wait before they can be used, allowing proper drying. When the time comes, the logs are stripped of bark, and chipped into inch-wide squares. They are stored until needed, and then cooked with tremendous heat and pressure. After this, they are are "digested" with a limestone and sulphurous acid for eight hours. The steam and

moisture is vented into the outside atmosphere, and the original wood becomes pulp. For every ton of pulp made it takes over three tons of wood, initally.

The pulp is washed and bleached, both stages requiring thousands of gallons of clean water. After this, coloring is added to more water, and is then combined in a ratio of 1 part pulp to 400 parts water to finally make paper. The pulp/water "brew" is dumped onto a web of bronze wires, the water showers through, leaving the pulp, which, in turn, is rolled into finished paper.

It must be noted that this is the paper making process. All cutting, printing, packaging, and shipping, requires additional time, labor, and energy, on top of the already exorbant amounts of capital, electricity, chemicals, and fossil fuels used.

Where it comes from: Plastic.

Plastic comes from oil, and the oil industry is no small operation. In many places around the world, and in the U.S., sites exist where the geologic conditions are such that a gas and oil concentration has been trapped. Upon location of these traps, a hole is drilled and a pipe rammed into the oil deposit. The oil is pushed to the surface due to pressure in its chamber, and also from the weight of earth above. The oil drilling operation, itself, has become a rather small and sterile undertaking. An oil drilling/pumping rig is roughly the size of a house, and very little oil is spilled, anymore. Literally, you could 'mine' oil in your backyard.

At the drilling site, a storage drum is filled, and, when full, the content oil is loaded into trucks, but sometimes piped, to a refining facility. This is where plastic is made.

Plastic comes as a by-product of oil refining, and uses only 4% of the total worlds oil production. It is a 'biogeochemical' manipulation of certain properties of oil, into polymers, that behave 'plastically.' Plastic polymers are manufactured into 5 main types, of which, plastic bags are made of the type known as Polyethylene. Raw Polyethylene comes from oil refineries as resin pellets, usually 3-5 mm diameter, by 2-3 mm tall. The raw material, as it is called, since it is plastic, can be manipulated into any shape, form, size, or color. It is water tight, and can be made UV resistant. Anything can be printed on it, and it can be reused.

Since plastic is so maliable, there are numerous process used to turn plastic into finished goods. To make bags, a machine heats the Polyethylene to about 340 F and extrudes, or pulls out from it, a long, very thin, tube of cooling plastic. This tube has a hot bar dropped on it at intervals however long the desired bag is to be, melting a line . Each melt line becomes the bottom of one bag, and the top of another. The sections, then, are mearely cut out, and a hole that is to be used as the bags' handle is stamped in each piece. Further finishing may be done such as, screen printing, however, for the majority of bags, it's off to the stores, etc., where they will be used.

With the exception of large, fuel burning, heavy machinery, used in the aquisition of oil, the entire plastic bag making process uses only electricity. The electricity used from start to resin/raw material is mostly nuclear. The power used in the bag manufacturing, for the most part, comes from coal fire power plants. One interesting note is that approximately 50% of the electricity generated from coal burning power plants is not from coal at all, it is, in fact, wrought from the burning of old tires, they being made of rubber, which is plastic.

Where it goes to: Paper.

When paper is thrown away, it can go to one of two places: The landfill or the recycling center. If it goes to the landfill, it will decay in time. If it is recycled, the paper will go through a lengthy process of disintegration and renewal.

When paper first reaches the recycling center, it must be returned to the state of pulp by using many different chemicals, such as sodium hydroxide, hydrogen peroxide, and sodium silicate. These chemicals will bleach and disperse the pulp fibers. The fibers are then run through cleaning and screening sequences which remove any contaminants. The pulp must then be washed with clean water to remove ink particles that were removed from the paper by the chemical process.

Flotation is a widely-used method of removing the ink. The pulp is submerged in water, and heated. The ink attaches to air bubbles, which must then be removed before they break and let the ink float back to the pulp. This is a tedious process, involving a watchful eye and careful timing.

Most recycling centers will treat the water they used, and remove any contaminants. Screens and mechanical cleaners are the most common, which may let chemicals slip through. Another clean-up treatment that these centers will use is called "sludge handling". Sludge is composed of water, inks, pigments and small particles of waste. The materials are separated and cleaned. By including this process, it reduces any waste that may have to be taken to the landfill. These materials can be used in bricks and fertilizers as well as other useful products.

Where it goes to: Plastic.

Like paper, when plastic has been used, it can go to one of two places: The landfill or the recycling center. In a landfill, plastics make up 7% of the waste by weight, and 18% by volume. Of the 44,100 million pounds of plastic products made each year, 26,700 million pounds ends up as municipal solid waste.

As landfill useage decreases each year, it is becoming more popular to incinerate our garbage. Today, with the requirement of emission controls on smoke stacks, burning garbage is 99.9% cleaner than in days of yore. About 10% of all garbage is burned, of this, plastic makes up, as previously stated, 18%.

One of plastics greatest assets is its recycleability. To recycle almost any kind of plastic is to mearely re-melt, and re-form. The re-melting will sterilize, allowing any recycled plastic to be used in even hospital grade products. And plastic can be re-formed into anything, many times over before it becomes brittle, whence it can be made into an ashtry or a mouse pad. If society were to implement a strict plastic recycling, an enormous percentage of plastic would efficiently be used, again.

Impact: Paper.

The recycling of paper is essential in cutting down on landfills: each day, enough paper is recycled to fill a fifteen-mile long train of boxcars. When this statistic was taken in 1993, only 40 percent of paper used was being recycled. That left a lot that was thrown into landfills. By the year 2000, it is estimated that 78 percent of all paper used in the United States will be recycled, as well as 15 percent of all paper overseas.

Buying recycled paper is usually more expensive than buying virgin paper products, but the government, in an attempt to encourage recycling, presented purchasing mandates that can allow a 10 to 15 percent price premium so that it can compete with other cheaper paper products.

Another factor to consider is water pollution. The making of paper, whether virgin or recycled, uses many thousands of gallons of clean water that can soon become polluted in the papermaking process. Virgin paper creates 35 percent more water pollution than recycled paper. Recycled paper also creates 74 percent less air pollution than virgin paper. However, both types of paper can contribute to contaminating area waters. Scientific evidence shows that fish can experience adverse effects through chemicals that reside in sediment. It can more than three years for any level of toxicity to lower.

Impact: Plastic.

Plastic impacts in two ways: First, it hits the environment in its use of electricity when being manufactured. More than half of the power needed to make plastic bags is generated by nuclear fission. While controversial, it is argued that nuclear power puts no direct harm or detriment into the environment. The only drawback to nuclear power is the radioactive waste, which is, so far, being safely diposed of in deep underground caves. And, in deep sea trenches where the nuclear waste is subducted into earths mantle and incinerated.

Pertaining to the rest of the electricity needed to make plastic bags, coal fire does pollute. But, plastic can be burned. In fact, the burning of plastic will yield from 10,000 to 20,000 btu per pound, of which 60% can be recovered. As stated above, plastic is burned to create electriciy, hence, we could use plastic to make plastic, and reduce sulphur emissions from coal.

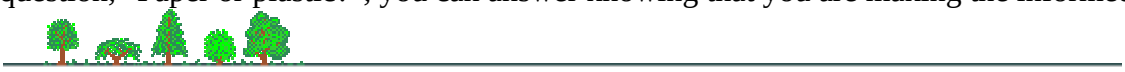
There is the question, though, of recovery of energy by burning plastic. This, too, causes controversy but only because of mental block. If 93% of all oil is burned straight away, why can't the 4% used as plastic have a second life as energy? The burning of plastics isn't without its drawbacks. Inks and additives to some plastics can create dioxins, and emit heavy metals when burned. Also, after being burned, the toxic ash still needs to be disposed of in toxic wase dumps. Another problem with the incineration of plastic is the arguement that the energy produced by the process doesn't justify the misuse of a limited natural resource. The plastics already produced are better utilized by making new plastic materials by recycling.

The second way plastic impacts is through landfills. Plastic will never break down; It will never disappear. Biodegradeable plastic is a misnomer because wood fiber has been mixed with the plastic so when buried, the wood dissolves leaving a million tiny pieces of plastic, instead of one bag. As stated, plastics make up 18% of waste by volume, and 7% by weight. If plastic were to be replaced in its uses by other materials, rubbish weight would increase by 150%, packaging would weigh 300% more, and energy consumed by the industry would increase by 100%. It has been found that the reduced weight of plastic has spillover benefits, elsewhere. Reduction of weight in aircraft saves an average of 10,000 gallons of fuel per plane, per annum, world over. In automobiles, it is directly responsible for doubling the fuel efficiency since the 1970's. Applied to plastic bags, they reduce weight in landfills; They take up less

space. This being in light of the discovery that most landfills are air tight, not allowing decomposition, leaving readable newspapers and chicken bones with meat still on them.

Conclusion

The making of paper can waste many thousands of gallons of water, as can the recycling of paper. The human and mechanical efforts and costs are very high, not forgetting the physical cost to loggers and those who work around the numerous chemicals. Plastic is, by comparison, efficient and low energy to produce, and, easily and efficiently recycled. Plastic reduces, recycles marvelously, and in that, is reused. After contrasting the efforts behind the making of paper and plastic, it is our unbiased opinion that plastic is indeed more beneficial to the environment, in that it is less harmful. The next time you are asked the dreaded question, "Paper or plastic?", you can answer knowing that you are making the informed choice.



Sources

Arnold, Frank. "Life Cycle Doesn't Work." The Environmental Forum. Washington, D.C. Vol. 10. No. 5. Sept. 1993.

Banuri, Tariq, ed. Who Will Save the Forests? New Jersey: United Nations U., 1993.

Borchardt, John K. "Chemistry of Unit Operations in Paper Deinking Mills". Plastics, Rubber, and Paper Recycling. Radar, Charles P., ed. Washington, DC: American Chemical Society, 1995.

Convex Plastics. Web Site. New Zealand. 1996.

"Degradeable Additives for Plastic Compost Bags." Biocycle. Vol. 36. No. 3. March, 1995.

Goff, Matthew. "Paper Vs. Plastic: The Great Supermarket Debate". Web Site (Linked). 1997.

Janda, Bruce W. "Advances in Paper Fiber Recycling: Meeting the Challenge". Plastics, Rubber, and Paper Recycling. Radar, Charles P., ed. Washington, DC: American Chemical Society, 1995.

Northern Paper Mills. Wood to Pulp to Paper. Milwaukee, WI: Wetzel Bros., (no date).

Scandia Plastics. (Interview). Sheboygan, WI. 1997.

Weaver, Rob. "Determining the Density of Plastic". Industrial and Environmental Chemistry Spring 1996. Indiana University of Pennsylvania.