



## Using Trash to Overcome Trash

# A Technique for Purifying Factory Wastewater with Materials Produced from VHS Video Cassettes

*In a recent edition of this magazine, we discussed a technique for recycling styrofoam using limonene. However, Sony's recycling efforts are not limited to that project, but rather consist of continuous ongoing research. For example, we have discovered that the plastic used in video cassettes and TV set cases has the possibility to purify factory wastewater.*

## Latent Possibilities in Waste Plastic

"Let's take a look at what actually happens." Yasuhiro Inagaki of the Center for Environment Technology at the Sony Corporation Research Center took two test tubes and poured wastewater samples into each. He then added a few drops of a black fluid to one and stirred it gently. Before our eyes the contaminants in the tube began to precipitate out. This black fluid actually is a coagulant made from discarded VHS video cassettes.

Currently, about 9 million tons of plastic are discarded annually in Japan. Of that, almost all is either dumped in landfills or incinerated.

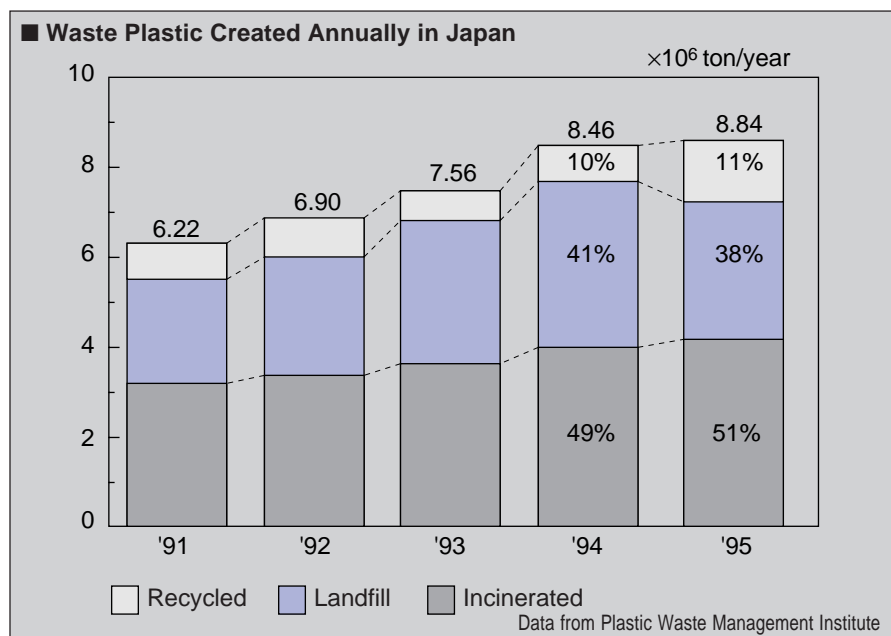
ated. Only about 10 percent is recycled. (See graph 1.)

"The reason for this is that the plastic in common trash is a complex combination of many types of plastic: polystyrene, polyethylene, polypropylene, and others. Also, the form of these materials is extremely varied, including films and bags, molded products, containers and plastic bottles, styrofoam, filaments, and mesh. Thus, even if these materials were recovered, recycling them would be extremely difficult. However, the waste materials associated with home appliances mostly consist of polystyrene and ABS, and thus the composition and form of the materials is limited. Furthermore, since there are few impurities, this waste material can be a source of high-quality polystyrene. Our research thus started with the question of how could this material be used."

However, there was one problem. Polystyrene itself has the advantage that the cost of the raw materials used in its manufacture is extremely low, which is why it is used as the case material in cassettes, TV sets, and air conditioners. Although there are advantages in reusing high-cost plastics such as the PET material used in plastic bottles, which have recently begun to be recycled in Japan, with low-cost materials it is cheaper to use new than recycled material. "Thus the one additional question was how to find value in recycling low-cost polystyrene, that is, how to provide added value in the recycled material."

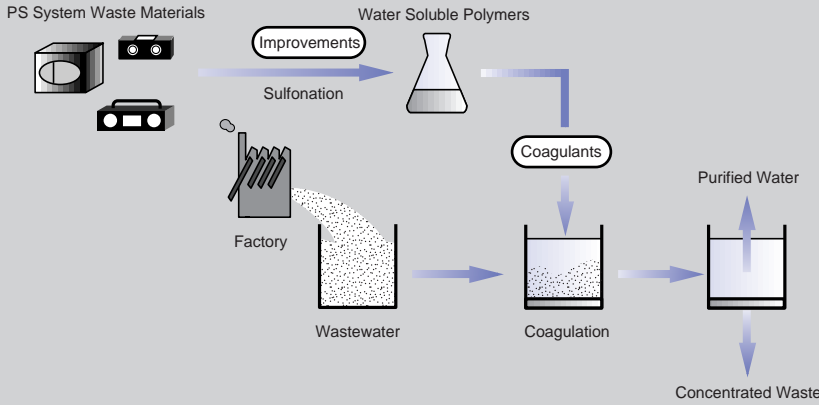
The technology Sony developed in answer to this question was to improve the quality of the material by producing water soluble polymers through sulfonation and to use that material as a coagulants for factory wastewater. The material from one video tape cassette can process 65 drums (about 13 tons) of wastewater. We wondered why this research focussed on coagulants. Mr. Inagaki explained that "From 1989 to 1994 I worked for the semiconductor division where my work was not completely unrelated to wastewater." However, previously I had worked on coagulants, and I was very interested in how they function. This is the main reason. Later, I transferred to the Research Center and worked on research concerning the use of sulfonation technology, which is used in this work, to increase the heat resistance of polystyrene. Then, in the course of considering new research subjects, I investigated the chemical structure of coagulants and realized that they include large amounts of polystyrene."

While the precipitation rates provided by these coagulants are somewhat slower than those of commercial products, it was discovered that they provide superior cleanliness (lack of contamination) in the supernatant liquor. Further research revealed that



### ■ Factory Wastewater Processing System

First, impurities dissolved in the wastewater are neutralized and precipitated out. This contaminated material is then converted to large clumps using coagulants. The purified water and the contaminants are then separated using filters. The water is discharged to streams and rivers, and the contaminants are dried and disposed of in landfills or incinerated. However, Sony Corporation recycles these contaminants as raw material for cement.



at the practical application of this technology. “We built a mini-plant at the Atsugi Technology Center, and collected data from actual wastewater. Since the composition of the wastewater depends on what the factory is producing, the coagulant blend must be adjusted accordingly. We are aiming at project completion by the year 2000.”

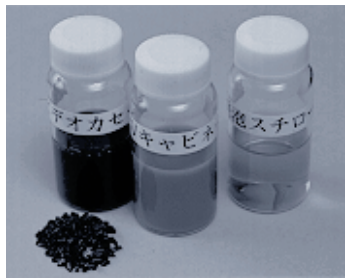
An important point concerning the collection of waste materials is Japan’s recycling law, which goes into effect in 2001. This is because that law mandates the collection of television sets and other consumer products. With this law in mind, the Home Appliance Association, which is made up of home appliance manufacturers, is planning to establish a television set collection and disassembly line. This plant will be able to disassemble several tens of tons of TV sets annually and provide high-quality waste materials.

“However, the amount of coagulants required by Sony internally is quite small. When full-scale recycling comes on line, it will simply not be possible to reuse all that waste material as coagulants. We currently plan to start by only using Sony internal waste materials for this project.”

Mr. Inagaki continued: “I think we should not depend only on coagulants, but rather should have competition between a variety of recycling methods. The limonene technique is one of those, and others include reconversion to oils and remolding. Materials that cannot be handled by one of these other methods could be used for coagulants. I think that the ideal system would be to use a variety of methods and decide which to use on a case by case basis. There are still many more possibilities for recycling.”



**Yasuhiro Inagaki**  
**Manager**  
**Center for Environmental**  
**Technology**  
**Sony Corporation**  
**Research Center**



■ **The color of the coagulant differs depending on the pigments in the waste material that was used as the raw material.**  
**From the left: video cassettes, TV set case material, styrofoam**

at a certain ratio, a combination of two materials resulted in improvements in both the speed of precipitation and cleanliness. “That is, we can aim at achieving both an improvement in the coagulation effect over current practice and at the same time reduce the amount of coagulant added as compared to commercial coagulants. Since commercial coagulants are also made from petrochemical fuels, this can also lead to a reduction in the amount of petroleum used. Furthermore, this material provides added value on the order of ten times that of low-priced polystyrene.”



■ **Coagulation using coagulants made from discarded plastic**

## ● Towards New Possibilities for the Next Century ●

Since this research only started in February of last year and has already led to newspaper publication, this work is progressing at a rapid rate. “Actually, this work only took about a month to complete. However, when we presented this work at the July open house at the Research Center, Sony’s chairman was impressed and asked us to announce it in the press. Thus things moved along at a rapid pace. When this work was published in newspaper articles we received responses from the public offering to send us their unnecessary video cassettes. Just turning down these offers was a lot of work. We returned the tapes explaining the work was still at the research stage.” It was discovered that not only video cassettes, but also TV case material and even styrofoam can be used to make coagulants with a certain degree of effectiveness. Mr. Inagaki is now engaged in research aimed

### What are coagulants ?

While one might envision filthy muddy water when one hears the term factory wastewater, wastewater is actually clear, even before processing. For example, the wastewater from the Atsugi Technical Center includes sulfuric acid and other chemicals since it was used in washing semiconductors, so it must undergo some form of treatment before being discharged. Coagulants are materials used in that process.