

PVC Plastic: A History of Systems Development and Entrenchment

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The paper investigates the developments of PVC applying a system oriented approach and a network approach to find explanations. The case of PVC is used to illustrate the models, but both models may be used to research other technological systems.

In the second part of the 19th century the first synthetic materials were discovered. But at that time chemists were not keen to apply their research results, instead they were interested in the basic research.

Although the material itself was discovered earlier, the year 1912 is the beginning of PVC, as then a production process was found. At this time the PVC production was still difficult. Processes for production and usage of the new material had to be adapted. Also regarding quality PVC struggled to keep up with its alternatives.

Nevertheless, PVC was interesting to the chemical industry, as it faced overproduction of acetylene and chlorine. Here it is necessary to not only take the system of PVC into account, but also look at the networked relationship to other systems. Acetylene was produced in large amounts as it was expected earlier that it could be used for lighting and other purposes, but this did not happen as expected. Chlorine was a by-product in the production of sodium-hydroxide. These two systems, or better the reverse salients in them, influenced the PVC system.

Soon PVC faced the problem, that companies found it difficult to process, and that consumers judged the products to be inferior. This led to a ceasing commercial interest in PVC. Despite this the basic research in the area went on. As the discovery of polymere structures re-sparked interest again, many companies formed research centers. As a result many plastizers were found, to make PVC much easier to process. Also the properties of the products could be influenced much better. This opened up new areas of application.

Two issues remained. The products, especially the inferior quality PVC, became brittle over time. The other problem was consumer ignorance. The consumers cleaned the PVC products in boiling water, thus decreasing product lifetime substantially. Both issues led to dissatisfied consumers.

The later reverse salient was tackled by consumer education. But the quality issue was only resolved by the discovery of a new production process: suspension polymerization

In the 1950s an annual increase of production by 50% led to much reduced costs, thus spreading the material in all areas, both application areas and geographical areas.

Then the system hit another reverse salient, sparked by an incident which became known as Miamate. This was a town in Japan where severe illnesses could be traced back to the pollution emitted by the PVC production plant. Mercury had been spilled into the sea and consequently the consumption of seashells was toxic.

The chlorine-compounds in the PVC led to environmental degradation. Consequently, the support from both consumers and politics diminished. And an environmental movement was formed against the PVC industry.

As a reaction the industry improved waste management and re-use of PVC. The method of incineration which was convenient and least capital expensive was later to be replaced by chemical recycling. This meant processes to convert plastics to monomers, which then could be used in new products again.

Also the industry withdrew from the packaging industry, sacrificing this business branch completely. This was only a marginal part of the PVC industry, but producers could not easily be convinced to use PVC anymore and also available alternatives put PVC in a hard position.

But by giving up this industry branch, the consumer organizations were satisfied. PVC production on a large scale could go on.

Today, PVC is deeply entrenched in society. This can be explained by the large amount of capital invested in research and development by the PVC industry.

The removal of the packaging application of PVC was an example of de-entrenchment of a system. By this de-entrenchment the PVC industry could now concentrate on their core businesses. This was considered an advantage.