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DATE June 15, 1971

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FROM Virginia Pitts

AT New Haven

SUBJECT POLYVINYL CHLORIDE - Current Awareness)
NHTIS 71-30 Supplement II
Project 8625-001 37

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38 Polyvinyl Chloride Current Awareness

Attached is our most recent collection of patents and articles on polyvinyl chloride. We have also included a few references on Toxicology problems in the vinyl chloride area.

As in the past, we will obtain copies of abstracted articles or full copies of those in which only the first page has been included as you request them.

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Sources:

British Plastics - March 1971
Flooring - April, May 1971
F&S Index of Corporations and Industries - March 2-May 4, 1971
Modern Plastics - April - May 1971
Plastics and Rubber Weekly - March - April 1971
Plastics Technology - April 1971
Plastics World - April-May 1971
SPE Journal - April-May 1971

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Chemical Abstracts References

ABSTRACT NO. 074463

CA VOL. 74, NO. 15
SECTION 14

PROFILE C1L0901418

POPOW, JERZY. (AKAD. MED., BIALYSTOK, POL.).

EFFECT OF POLY(VINYL CHLORIDE) (PVC) DUST ON THE RESPIRATORY SYSTEM OF THE RAT.

RGCZ. AKAD. MED. BIALYMSTOKU(SUPPL. 24), 5-48, 1969. (ASTM CODEN: RJMBA). ORIG. LANG.: POL.

INDEX TERMS: SCA0140005 TOXICITY PVC

SEARCH TERMS PRESENT: TOXIC VINYL CHLORIDE

WEIGHT FOR THIS CITATION: 1

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Flooring

April 1971

Union Carbide Develops Vinyl Carpet Backing

Union Carbide Corp. has announced development of the ULOK vinyl carpet-backing system, which —it is claimed—enables manufacturers to substantially reduce the cost of vinyl backing for carpet.

The ULOK system involves a series of component chemicals and

procedures for compounding them and applying them to carpet.

Union Carbide says the reduced cost possible through the new system makes vinyl backing competitive with high density foam backing.

Pound for pound, foamed vinyl backings are far stronger than rubber foams, Union Carbide claims. Even at low densities, backings foamed with the ULOK system exhibit excellent resistance to scuffing, shredding or tearing in heavy or wheeled traffic installations, the company reports.

Union Carbide is providing technical assistance to carpet mills in adapting conventional latex equipment to the vinyl system. This adaptation can be readily achieved, the company says.

Plastics Technology

April 1971

Comments on Disposal of PVC Scrap

...We recognize that the burning of plastics, or any material for that matter, in a small plant incinerator is a problem. The addition of limestone will reduce the amount of HCl that will be evolved. However, it will however make burning more difficult and will increase the weight of the ash to be hauled to the landfill. ... Currently...the most satisfactory technique is that of a properly supervised landfill operation. Incineration of plastic materials as part of municipal refuse is also satisfactory and perhaps a question and answer technique on this subject (below) would be a way of letting you know how we view this.

What is the current level of PVC in municipal refuse? A survey made by the Battelle Memorial Institute in 1966 showed that the total amount of plastic disposed of in municipal refuse was 3-1/4 billion pounds or about 1.5 % of the total amount of refuse generated. The current level (1970) of plastic materials in municipal refuse is estimated to be 2%. This level is expected to reach 3% by 1976. About one-third of the total plastics in municipal refuse is PVC.

Does this level of plastics in municipal refuse cause any problems? This same survey by Battelle showed very few references to problems created by plastics in municipal waste. It was felt that because plastics make up such a small portion of municipal wastes, their effects on disposal systems could not be measured.

What are the combustion products from HCl? An extensive study of the combustion products from PVC was completed in 1969. This study was made at the School of Public Health at the University of Michigan under a Public Health Service Research Grant (HEW). In general, this research showed that HCl, carbon monoxide and carbon dioxide were the major combustion products. Under conditions of incomplete combustion, small amounts of hydrocarbons are also produced. In this same study, it was also shown that phosgene and chlorine are not present in the combustion study from PVC.

How much does PVC in municipal refuse contribute to our total air pollution problem? The current level of PVC in municipal refuse is not sufficient to create any air pollution problems. A study was made of this problem by the Royal Academy of Engineering Science in Sweden. It was their conclusion that the amount of pollution due to the burning of PVC was only 0.05% of the total air pollution problem in 1968. We are, nevertheless, much concerned about this small amount and are currently directing our research efforts toward the elimination of all air pollution that might occur from burning PVC.

OLI 7619

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FIRE SAFETY FOR PLASTICS

ARE plastics a fire hazard? How can the hazards be assessed? How can they be ameliorated?

A good basis to start from is an article by Dr Helmut Birkner and Dr Klaus Diebel, in German, in the house journal of Chemische Werke Hüls, called *Der Lichtbogen*.

The article begins from the viewpoint of plastics in building construction, notes the confusion—as in Britain—in terminology arising from the lack of definition, and goes on to the German standard classification of building materials, in DIN 4102, which groups the combustibles into three groups: difficult to burn, easy to burn, and something between the two.

The DIN test is described and it is noted that various materials fall into various groups. For some building purposes, only the highest group is permitted, 'difficult to burn within the meaning of DIN 4102'.

Rather than translate the ambiguous German into equally ambiguous English, it is better to begin at the beginning.

All organic compounds having carbon-carbon or carbon-hydrogen bonds are combustible; it is inherent in the molecule and differs mainly in temperature.

That may not be saying much that is helpful when you consider how combustible even metals can be.

But it does mean that there can be no actual incombustibility of organic polymers, whatever treatment you give them.

What is useful to remember about polymers is that there is a wide range of combustibility, of ignition temperatures, of continuity of burning, of degree of self-

by CHARLES JENNINGS

extinguishing. Also, remember that it takes two to make a fire: the substance that burns and the atmosphere it burns in.

From these considerations has been devised a test, called the oxygen index of inflammability, OII, which has proved to be one of the most precise and reproducible of the several indices of flammability or combustibility yet developed for polymeric materials.

Essentially, the index is the percentage concentration of oxygen, in a mixture of oxygen and nitrogen, which will just sustain equilibrium burning of the material under test.

In an article in *Der Lichtbogen*, the authors call it the 'J' oxygen index and quote figures like:—

pfe	0.95
pvc	0.45
pc	0.26
pp	0.17
pe	0.17

It will be noticed that the earth's atmosphere—with which we are almost always concerned in cases of fire—has a J figure of 0.21, so that pc will not just burn in air under ordinary conditions, but pp and pe will.

Those J figures are for the uncompounded polymers but they can be substantially raised by adding suitable 'fireproofing' agents.

Birkner and Diebel discuss such agents, dividing them into three classes: filler additives, reactive ingredients, and after-treatments. The reactive ingredients are, broadly, the most potent and the most popular, giving an in-built protection.

When the three types are

looked at from the point of view of the essential requirements of a good fireproofing agent (reduction of burning, no deleterious effects on processing or working, no degradation of physical properties, and non-toxicity,) compromises are often necessary.

Flameproofing agents, like halogen—, phosphorous—, and antimony-containing compounds are considered in some detail by the authors who present an interesting table of the flameproofing substances referred to in recent patent specifications.

Three types

They are classified into three types: (1) organic additives like chlorinated paraffins, bromine compounds, and halogen phosphates, (2) inorganics like antimony trioxide, zinc and barium borates, (3) synergists like peroxides and hydrazine.

Of course, proportions are crucial and the form of the polymer—film, foam and block—is important.

An important part of the paper is devoted to test methods. Differential thermal analysis (DTA) and thermogravimetry (TGA) give the most fundamental insight into what goes on during burning, but the more simplified and practical tests, generally imitative of the special conditions of each situation, differ so widely in the conditions of testing and assessment of results that Hüls have been forced to design their own test for their development work.

Even when the problems of

measuring and improving the burning characteristics of plastics are lined down to the small area of a single material, polyurethane, and a single form of that material, flexible foam, they seem to be only a little easier to solve.

That is the general message of the paper by R. M. Pruitt in *Journal of Cellular Plastics*, November/December 1970, pp. 262-6, on the self-extinguishing characteristics of flexible urethane foam.

In opening his paper, the author thrashed about over the same ground of ambiguity and lack of definition, as worried the German authors, pointing out that 'of some fifty tests for flexible foams, none consistently correlate with foam in service conditions'.

Pruitt also classifies flame-resistance treatments into three kinds: (1) intumescent, shielding materials, (2) diluting fillers, (3) chemical interference with the burning.

The last has been the traditional approach, generally involving halogen- and/or phosphorus-containing compounds. But Pruitt makes two valuable points not mentioned by the Germans.

These are that bromine is more efficient than chlorine and that both have a synergistic effect with phosphorus. A large part of the paper is, in fact, devoted to examining the relationships between these three elements.

Physical effects on the rate of burning must not be overlooked. They are very obvious in urethane foam when comparing the results of using different types of isocyanate, such as TDI and MDI. Each of these, used alone, produces foams which are not self-extinguishing, yet, used together, the produce a foam which is self-extinguishing.

The cause seems to be that the mixture produces a foam which, on ignition, melts and flows away but then chars and so insulates the foam from the heat of the flame.

This effect leads on to the idea—an old one—of using incombustible, inorganic substances, incorporated by soaking the finished foam in a suitable solution or dispersion, followed by drying out.

Pruitt recommends $MgNH_4PO_4$ and the similar calcium salt, both of which are cheap and effective although expensive to incorporate.

Pruitt concludes with an

examination of how far practical burning test—small, uncovered cushion, the foam, ignited by a sheet of burning newspaper—correlates with the standard laboratory test, ASTM D166.

Correlation was indeed poor that Pruitt pointed remarks: 'we must ask ourselves if we want to continue playing the test-pass game.'

This final judgment may not be entirely acceptable because the 'service test' itself is not above suspicion being not really representative of what actually happens to an upholstered seat when there is a fire in a room or a vehicle.

OLI 7620