RADAR, HULA HOOPS, AND PLAYFUL PIGS

It was an accidental discovery, but it changed the eating habits of the nation, altered the outcome of the Second World War, and produced hula hoops, toys for pig, and burpless babies. And let's not forget Frisbees and Barbie dolls. We're talking about polyethylene. The chemical name may not ring a bell, but almost everyone is familiar with this material in the form of shopping bags, squeeze bottles, margarine tubs, cling film, or the tags on pillows and mattresses that bear an ominous warning about the legal consequences of their removal.

Our story begins one Monday morning way back in 1933. Two organic chemists working at Imperial Chemical Industries (ICI) in England began the week by checking up on an experiment they had begun the previous Friday. Their research focused on chemical reactions at high pressures, and they had designed an experiment in which a petroleum-derived gas called ethylene was mixed with another reagent in a pressurized cylinder. Much to their surprise, the tank

gauge showed no pressure on Monday morning. They feared their reagents had leaked out, but closer examination revealed the presence of a whiter powder in the reaction vessel. The small ethylene molecules had joined together to form giant molecules of polyethylene. The two chemists had discovered a new plastic.

Within a short time, the techniques needed for mass production had been worked out and the only thing left to do was to determine a use for the new material. At this point, the British Telegraph Construction and Maintenance Company found out about polyethylene an decided to try it as an insulator for underwater cables. By 1938, a telephone cable had been successfully laid between the British mainland and the Istle of Wight.

And then war broke out. The Allies had been secretly working on radar, but they had failed in their attempts to install the equipment in airplanes. The device required a great deal of specialized insulation, but the materials available a t the time were all too heavy for use in the air. Polyethylene was light and fit the bill. Soon, the Royal Air force was flying missions with the help of radar, and British pilots sank over a hundred German submarines (U-boats) within a few weeks. Hitler ascribed the "temporary" setback to that "single technical device." The Germans worked feverishly to develop airborne radar equipment of their own but could not do so without the polyethylene technology.

The tide of battle had been turned. After this, war uses for polyethylene mushroomed.

Earl Tupper learned about the material while working as an engineer at the Dupont Company. He hit upon an idea that would permanently change people's eating habits by making leftovers easily storable. His brainchild, of course, was Tupperware, a line of molded polyethylene containers that were flexible, strong, and capable of providing an airtight seal.

Research soon yielded many new varieties of polyethylene. A special catalyst developed by two eventual Nobel Prize winners, Karl Ziegler and Guilio Natta, resulted in high-density polyethylene, which was stiffer and stronger than the original substance. Large-scale manufacture, though, led to problems, as the plastic cracked easily. Luckily, there was a commercial use for poor-quality polyethylene: the hula hoop. The hoop took America by storm. Rock and roll was transforming the nation, and everyone wanted to swivel their hips like Elvis. The hula hoop was the perfect teaching device. By 1958, twenty thousand hoops were rolling off assembly lines every day. When someone established, a world record by twirling fourteen hoops at the same time, it received extensive publicity. But for some, this was just too much hoopla. Many fundamentalists opposed the hoop because of the sexual innuendo of the gyrations. Indonesia went as far as banning the twirling, fearful that the motion might stimulate inappropriate passions.

Eventually, the problems with the large-scale manufacture of the material were worked out, and we now have a variety of polyethylenes for various purposes. Garbage bags, shopping bags, and cling film can all be made of polyethylene. The era of the burpless baby was born with the introduction of the small collapsible bags used as bottle inserts. Babies would no longer be sucking in air while being fed.

Even pig farmers have benefited from advances in polyethylene technology. When pigs are raised in the close confinement of piggeries, they tend to annoy each other. They nibble on their confreres' tails. This can lead to infections, so pig breeders often put rubber tires and bowling balls in pigpens to distract the creatures from their peers. Furthermore, when the pigs start pushing these toys around they get exercise, which promotes weight gain and prevents the pork from becoming watery due to improperly developed muscles. Now there is a new, improved pit toy, thanks to high-density polyethylene, which can be molded into balls that may be inflated with water. Contrary to what we may think, pigs don't actually like dirt; these balls are easily washed, since there are no holes or threads to collect dirt. The pig balls can even be adjusted in size as the pigs grow.

So polyethylene helped the Allies with the Second World War, and it gave us shopping bags, Tupperware, and toys for pigs. One of the substance's more recently developed uses has been in the manufacture

of artificial hip joints, which are made of ultra-high-molecular-weight polyethylene. These joints may turn out to be just the thing for those who suffer from polyethelenitis due to overzealous hula-hoop twirling.

And just when you think you've covered the spectrum of weird and interesting uses for polyethylene, another one comes along. I like to spice up my chemistry presentations occasionally with a little magic and a little humor. So one day I had an idea. Real magicians produce doves. Wouldn't it be appropriate for a "chemical magician" to produce a plastic dove instead? After all, plastics represent some of the most important chemicals we have. Why not begin a lecture on plastics by magically producing a "synthetic" dove? It took me a while, but I finally found an appropriate creator. It could even flap its elastic-powered wings and fly. Guess what the wings were made of? That's right, polyethylene! Now if we could make these wings bigger, they could perhaps be attached to pigs. I bet the animals would enjoy that even more than rolling around those polyethylene pig balls. And when will we finally run out of interesting uses of polyethylene to talk about? The answer is obvious. When pigs fly.