

July 20, 2004

Now, Diaper Technology Takes On a Desert

By OTTO POHL

DUBAI, United Arab Emirates - Plans for the Jumeira Islands development, a luxury residential project being built here, include acres of lush landscaping. But how can such greenery bloom in the sandy soil of this arid desert climate? To address that problem, developers are turning to an unlikely solution: the technology used in disposable diapers.

Disposable diapers are made of superabsorbent polymers, or hydrogels, that retain moisture. In the early 1980's, chemical manufacturers discovered that the same technology, with modifications, could be applied to products designed to improve soil irrigation. At that time, the discovery was hailed as a possible aid to poor farmers in the developing world who were seeking to grow crops in dry climates. But it never caught on; the products were too expensive, and their effectiveness was not proved.

But manufacturers are now finding their market growing, as worldwide demand increases for ways to stretch scarce water supplies.

Sales of hydrogels have increased about 10 percent annually in recent years, said Elke Nelles-Schwelm, director of Creasorb, a German company that makes Stockosorb, the product being used at Jumeira Islands. (Creasorb is a subsidiary of the German company Degussa.)

And the United Nations Convention to Combat Desertification began a project at the beginning of the year to use TerraCottem, a soil conditioner containing hydrogel made by the Belgian company TerraCottem N.V., for erosion control in Iran.

"It is the most ideal product so far we've found to fight desertification and land degradation," said Rui Zheng, the United Nations official in charge, adding that there were plans to expand the project to Kyrgyzstan. The problem for widespread use, he said, is the high price.

TerraCottem sells for about \$2 per pound, enough to treat about 50 square feet of land, said Willem Van Cotthem, the company's founder. That makes it affordable for applications like landscaping and tree nurseries, but still very expensive for general agriculture.

But at Nakheel, the government-owned company that is building the 740-acre Jumeira Islands, executives say the technology will have applications beyond making flowers grow in the desert. They see its potential for water conservation.

"Water is the major driver of conflicts in the region," said Dr. Imad Haffar, the Nakheel research and development manager.

In adapting diaper technology for irrigation, engineers had to consider that hydrogels in a diaper must absorb liquid once and hold it without seepage, while in soil, they must hold and slowly release water thousands of times over years or decades.

To make hydrogels, two monomers with an extremely strong attraction to water, acrylic acid and acrylamide, are combined to form polyacrylamide, a spongelike substance, which is then mixed in soil. There, it can easily absorb hundreds of times its weight in water; the design of the molecules controls the rate at which the water is absorbed and then released.

Proponents say the products can conserve about half the water otherwise needed, also reducing the amount of fertilizer needed. Since the ground retains the water longer, the technology can also help control erosion.

At Jumeira Islands, the soil additive could cut water consumption by 50 percent, saving about 1.5 million gallons a day, said Mehmet Gecekusu, operations manager at Albayader, the landscape company for the project. He estimated that the hydrogel would pay for itself in less than a year.

But hydrogels have drawbacks. Polyacrylamide is nontoxic, but acrylamide, one of its components, is not. Careful manufacture is needed to ensure that the acrylamide is completely incorporated in the polyacrylamide, and many products still contain traces of these toxins, which can kill the plants the product is intended to help.

Another challenge is the soil's content. Metals like iron and magnesium can permanently damage the molecular net in the soil, and salt temporarily interferes with the ability of polyacrylamide to absorb water.

Ms. Nelles-Schwelm of Creasorb, though, said that even in salty soil like that of Dubai, polyacrylamides can absorb 100 times their weight.



Les Ambrose, manager of irrigation and landscaping at Al Naboodah, a company that handles many of Dubai's largest landscape projects, said he was skeptical about the effectiveness of polyacrylamides. Nonetheless, he is testing TerraCottem in the development of the Palm, an enormous artificial island in the shape of a palm tree that is being built in the Persian Gulf off the Dubai coast.



Mr. Ambrose said he thought the products would catch on as soon as a high-profile project, like Jumeira Islands, successfully used one. Given the relative abundance of water today, however, Mr. Ambrose has a different dream for hydrogels.

"I could get 50 percent more landscape for the same water," he said.

Otto Pohl for The New York Times

Workers at the Jumeira Islands development in Dubai, top, prepare the soil with an additive meant to make landscaping bloom. Les Ambrose, above, is trying out a different additive at another project

Some companies have decided to avoid polymers altogether, investing instead in an array of other technologies that can increase water retention in soil. There are products based on silicates, volcanic ash and organic gels. The Austrian company Sanoway is even experimenting on installing electric grids below the soil's surface to draw groundwater upward without attracting the salts contained in it.

Several hurdles, including government policies, discourage extensive application of these technologies to broader uses. For example, for reasons of national security, the United Arab Emirates grows about a third of its own food. It is able to do that by subsidizing the price of fresh water to farmers, which reduces the incentive to conserve water.

In the private sector as well, economic incentives often run counter to water conservation. Real estate developers in this country, for example, try to complete a project for the lowest price, Mr. Ambrose said, and that motivation discourages incorporating anything that raises the up-front cost, like water-reduction technology. Subsequent water costs are passed on to homeowners as maintenance fees.

But Mr. Van Cotthem, developer of TerraCottem, hopes that product refinements and price reductions will allow hydrogels to reach their full potential. And he can wait.

"It took 30 years before mineral fertilizers were accepted," he said. "This breakthrough will be even bigger."