



By Stephen Fraser

# PUR and Simple

A modest packet is cleansing contaminated water around the world.

**G**reg Allgood must have seemed like a traveling magician to the woman in the rural village in Kenya he visited in 2001. He had arrived to demonstrate the remarkable action of a small foil packet.

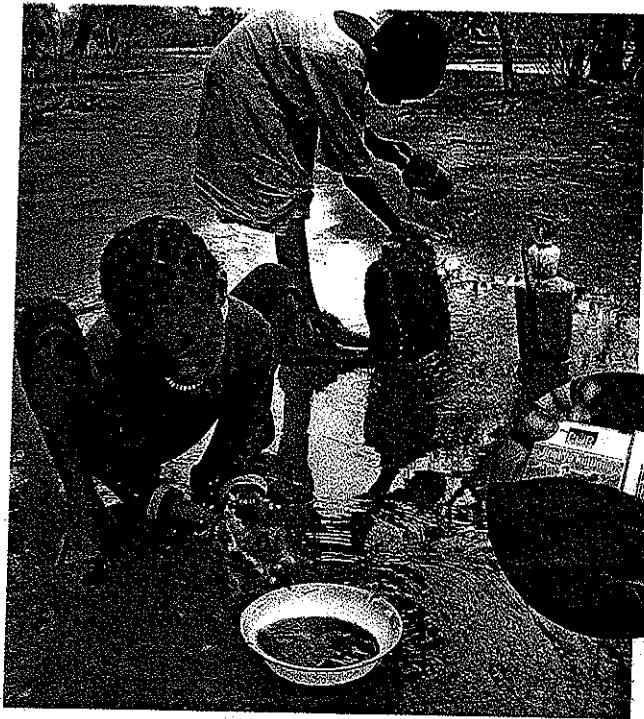
Allgood emptied the powdery contents of the 4-ounce packet into a jug of murky water. He stirred the solution for five minutes and then let it sit for another five while its dark contaminants settled at the bottom of the container. After 20 more minutes, the water was so crystal clear that the woman and her children could drink it. The woman was elated. She had never enjoyed pure drinking water before.

Allgood's demonstration wasn't magic. It was pure science. Since that trip to Kenya, Allgood has traveled the developing world, demonstrating and dispensing the amazing little packets. "There's nothing more rewarding than giving children their first glass of clean, purified drinking water," he says.

## 'FLOCCING' TOGETHER

Allgood (pictured at far right) is a *toxicologist* at Procter & Gamble (P&G) in Cincinnati. A toxicologist studies the effects of poisons on plant and animal life. Since 2004, Allgood has also been director of the company's Children's Safe Drinking Water program.

The small packages that Allgood dispenses are called PUR Purifier of Water packets. Two of his P&G colleagues in Great Britain, Phil Souter and Colin Ure, invented them. PUR packets contain *flocculants* (FLAH-kyoo-lehntss), chemical agents that make impurities *flocculate*, or clump together. The impurities flocculate into larger and larger particles until they become so heavy that they settle to the bottom of their container, where they can be easily removed. If your home has a swimming pool, flocculants are probably used to remove debris from it.



Left: A boy in Kenya sips water purified by PUR powder. Above: Children in a refugee camp in Sudan collect dirty rainwater for drinking and cooking. Inset: a PUR packet

The 30-minute process in which one PUR packet purifies 10 liters (2.6 gallons) of dirty water is comparable, in miniature, to that of a large municipal water purifying plant. The same ingredients go into both.

PUR packets are available in the United States. Many campers and boaters carry them to purify lake and river water for drinking. The packets sell for about \$1.50 each. They are most helpful, though, in emergency situations, such as floods and hurricanes, when municipal water systems malfunction and people are forced to drink whatever water they can find.

Emergencies aside, Americans take clean drinking water pretty much for granted. But many people around the world don't. They may get their drinking water from the same sources that they bathe in or share with cows, goats, and other farm animals. "It's water that we wouldn't even want to swim in," says Allgood. Often, the water is fouled by the runoff from crude sewage systems. An estimated 1 billion people in the world drink contaminated water.

Contaminated water may contain *heavy metals*, such as arsenic, lead, and mercury, which have a high atomic weight and are harmful to human health. Or it may be populated by parasites, such as *Giardia lamblia* or *Cryptosporidium*, which can cause persistent and painful diarrhea. It can also transmit life-threatening diseases, such as dysentery, typhoid fever, and cholera.

"Pathogens in drinking water result in the deaths of 4,000 children every day in the developing world," says Allgood. "More children and infants die from diarrhea in developing countries than from either AIDS or malaria."

Waterborne diseases have been called the "silent tsunami," says Malcolm Morris, chair of Millennium Water Alliance, a group of organizations whose mission is to help people in developing nations obtain clean water. "There are many competing needs that [world] leaders are faced with," says Morris. "However, if no provision is made first for clean water, I predict that no country will ever rise out of its poverty."

PUR is manufactured in Pakistan and sold to humanitarian groups at 3.5 cents a packet. So far, PUR is available in about 40 developing countries. Allgood says P&G plans to be producing enough PUR packets by this summer to provide up to 1.5 billion liters (396 million gallons) of purified water per year.

### CHANGED LIVES

After the woman watched Allgood purify the jug of dirty water that day in 2001, her feelings of joy were cut short. "The water was so valuable that someone stole it," says Allgood. "She begged us for our remaining packets, and we gave them to her. This showed me the amazing potential of this product to change lives."

"I've visited with thousands of children in hospitals, orphanages, schools, and their homes, and seen firsthand the difference that we're making in their lives with the PUR packets," says Allgood. "Children no longer die needlessly from cholera, dysentery, and typhoid fever." **CS**



### Packaged Ingredients

How does PUR purify? Each packet holds these ingredients:

- iron, in the form of *iron sulfate* ( $\text{FeSO}_4$ ): It is the flocculant in PUR and removes heavy metals
- clay. It speeds the formation of *flocs* (clumps of impurities)
- sodium citrate ( $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$ ): It brings water to a neutral *pH*, an indicator of the acidity or alkalinity of a solution. On a scale of 0 to 14, a pH rating lower than 7 indicates the water is acidic and a pH higher than 7 indicates that the water is alkaline. A neutral pH of 7 promotes the formation of flocs
- calcium hypochlorite ( $\text{Ca}(\text{ClO})_2$ ). It is a *disinfectant*, a substance that kills bacteria and viruses.