Energy for tomorrow

Regulating the mysterious methanogens

A group of National Research Council scientists in Ottawa has come up with a process for biogas production which is not only several times more efficient than systems now in use, but it may also skirt a crucial hurdle faced by industrial research – the scaling up of a small "bench" model to a much larger, practical system.

In theory, the concept is almost too good to be true – the conversion of plant and animal wastes that normally pollute to a valuable form of energy, the combustible gas methane. The problems of maintaining a clean environment and meeting society's energy demands are thus both tackled and, at least in part, alleviated.

Methane, the simplest member of a family of hydrocarbons that include gasoline and kerosene, is better known as "marsh" or natural gas, the principal ingredient in Alberta pipelines, sewage plant burn-off gases and, well, that age-old bane of social gatherings, flatulence.

But like those other, more popular sources of renewable energy, the sun and the wind, biogas has experienced difficulties of transition from the drawing board to functioning, practical systems. Simply put, making methane out of wastes has been too unreliable and inefficient a process to qualify as an assured energy source, a problem attributable both to the bacteria that mediate the sewage to methane conversion, and the structures of the fermenter systems themselves.

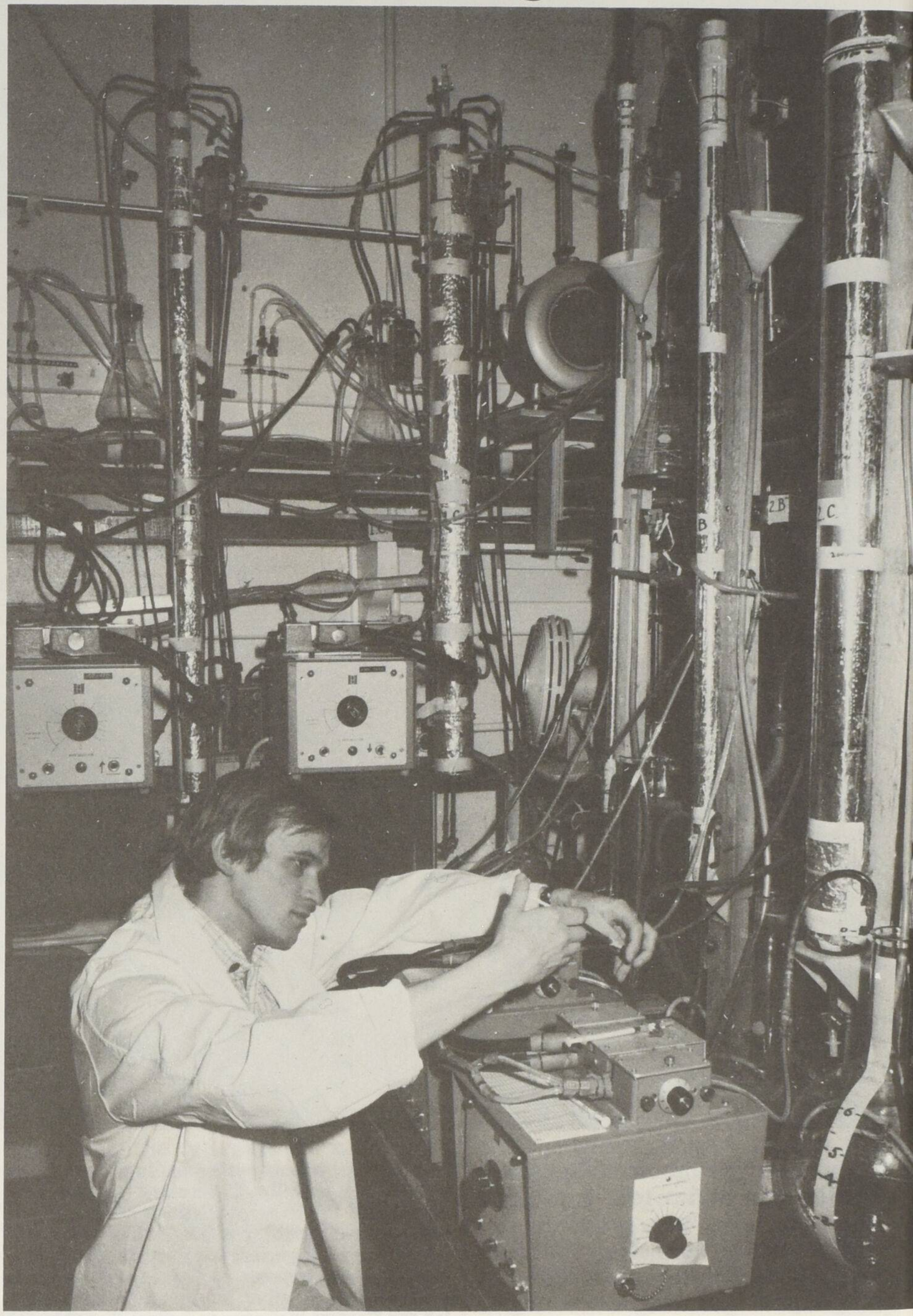
While scientists have no detailed knowledge of all that happens when bacteria break down wastes to methane, the general aspects of the process are known. There are at least two main events, according to NRC's Bert van den Berg: "At first a large part of the waste is broken down to small molecules such as acetic acid," he explains. "Then, this acid (the same stuff that makes vinegar) is changed to methane by bacteria called 'methanogens'.

"Until recently," says van den Berg, "the process hasn't been seriously considered in North America as an energy source. Municipal sewage plants have often been content to utilize it just to treat the sewage, burning off most of the gas as a troublesome by-product."

While other, more energy-hungry countries like India and China have used family- and village-scale biogas or "Gobar" plants for years, they are usually simple devices, little more than manure tanks with gas collectors.

Van den Berg's coworker Pete Lentz puts his finger on two basic problems. First, the mixed bacteria population is very sensitive, and easily stalled because of fairly strict limits on temperature and acidity, and a critical need for an oxygen-free or "anaerobic" environment. Second, the gas production takes time, due to the fact that the methane-producing bugs are intrinsically slowpokes, making it difficult to grow them in quantity; as well, the means of bringing the bacteria together with the waste material is inefficient in the large fermenter tanks commonly used.

It is this second problem that the NRC scientists looked into. Rather than focus on speeding up the methanogens' internal chemistry, a very complicated long-term project, they simply designed a much better fermenter. By making the bacteria grow



Milan Muzar at work on the laboratory setup for examining the biogas production of bacteria grown on the inner walls of glass columns. *(Photo: Bruce Kane, NRC)*

Milan Muzar travaille sur l'installation expérimentale servant à déterminer la quantité de méthane produite par des bactéries cultivées sur la surface interne de colonnes de verre. *(Photo: Bruce Kane, CNRC)*