OIL FROM ALBERTA'S TAR SANDS

For Canadians, one of the most important factors in balancing future energy supplies and needs is the bitumen locked in the vast tar sand tracts of northern Alberta. The total reserves of synthetic crude oil under these forested plains are estimated at 1,000 billion barrels, of which 250 billion barrels—or 70 per cent of the Middle East reserves—are recoverable by modern extraction technology.

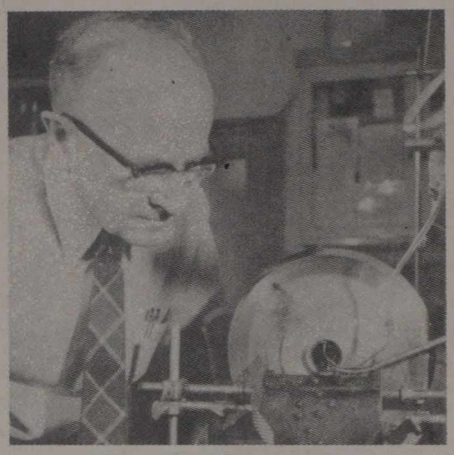
The problem, at least for the present, is how to remove the sand from the bitumen—a task made more difficult in many areas of the beds by the presence of clay, which tends to bind the two materials together.

One attractive alternative to existing technology is a process developed by the National Research Council (NRC) of Canada's Division of Chemistry called Spherical Agglomeration.

Dr. Ira Puddington, who recently retired as Director and now acts as a consultant to the Division, is one of the principal scientists involved in the work. According to him, Spherical Agglomeration is a general technique for separating the components of many kinds of mixture, tar sand extraction being one of its more visible applieations.

The name of the process describes its essence. When a mixture is suspended in an appropriate liquid and the right experimental conditions introduced, one or more of its components agglomerate or "pelletize" into spheres that separate readily from the remaining material.

"If the technique is used to upgrade ore, it is often the formed spheres that contain the valuable material," says Dr. Puddington. "In other instances, such as the upgrading of coal, it can be the unwanted impurities that pelletize, leaving the coal behind. This is the case with tar sand extraction, where sand and other undesirable substances are agglutinated into spheres, leaving the valuable hydrocarbons that make up bitumen behind in solution."



Dr. Ira Puddington

The process begins with the dispersion of untreated tar sand in a tank containing kerosene, followed by agitation of the system: The bitumen hydrocarbons dissolve because they are hydrophobic (literally, "water-hating"), while the sand and other hydrophilic (water-loving) materials remain in suspension. A carefully controlled volume of water is then sprayed into the rotating system, which preferentially wets the surfaces of these hydrophilic solids. On collision during agitation, these wetted surfaces adhere because of the surface tension that exists between the kerosene and water, thus building up dense, spherical particle clusters.

"It is the interfacial surface tension between these two immiscible liquids (kerosene and water) that acts as the binding force holding the agglomerates together," explains Dr. Puddington.

The extraction method now in use, which involves "scrubbing" the tar sand with hot water and steam, has a serious disadvantage not shared by Spherical Agglomeration. This is in the need for huge "tailing" ponds to contain the effluent produced by the process. The waters of these man-made lake—one of them measures nine square miles in area and reaches a depth of 300 feet—are murky with suspended clay and other fine mineral matter that do not readily settle out. As such, they cannot be discharged into the rivers of the area, and the volume of tailing water continues to increase. (These same contaminants are locked in the hard spheres of the Spherical Agglomeration Process).

It has been suggested that the two processes may, in fact, serve as valuable complements of one another. The tailing water may be too dirty for recycling in the hot water process, but its clay content makes it ideal for use as the bonding agent in Spherical Agglomeration. Thus, the NRC process would help eliminate, at least in part, the most serious drawback to hot water extraction.

Terra Energy of Calgary Limited has been granted a licence to exploit the agglomeration process in tar sand extraction. In the developmental research required to scale the laboratory process up to the much larger dimensions of a pilot plant, NRC has also provided financial assistance under its new Pilot Industry/Laboratory Program.

Should this novel process live up to its promise in tar sand extraction, as many scientists believe it will, then NRC will have played a vital role in one of the most significant energy resource developments of the century.