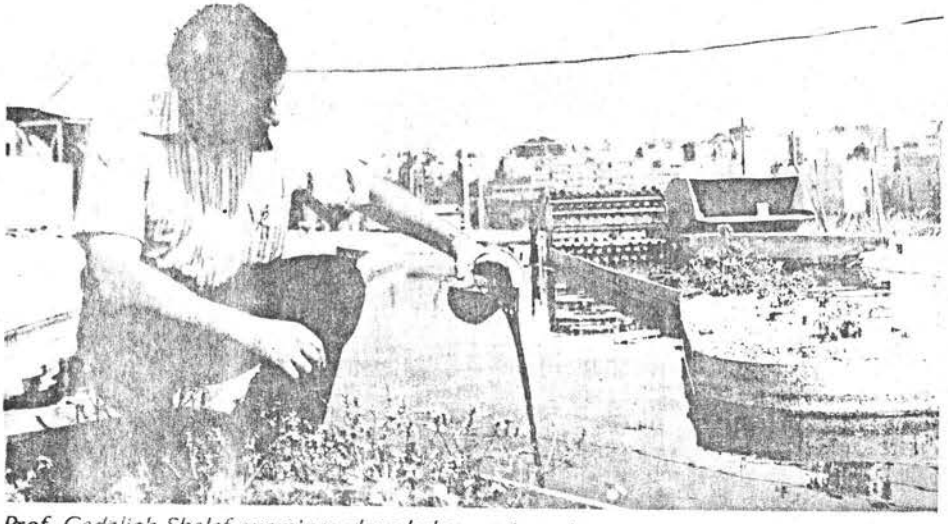
Reclaiming waste water

Israel has virtually exhausted its natural water resource potential. Its total annual water consumption for all uses – agricultural, industrial and municipal – is about 1.6 million cubic meters. One-third of the water supply comes from the Jordan River, and almost all the rest from the major groundwater sources, one along a 140 km stretch running down the coastal strip and the other in the mountains. This supply is adequate for Israel's present-day population of 3 million. But what about the future, as the country continues to develop its industrial base, as population grows and consumption increases?

According to the master plan for water, 1990, Israel's water consumption will increase by 3 million cubic meters.



Prof. Gedaliah Shelef examines algae-laden waste water

All of the incremental supply will come from waste water reclamation – a relatively new technique which has been studied in various countries including the United States and Germany. In Israel, a special project was set up with financial assistance from West Germany, based on Israel's unique climatological conditions and needs. It is the largest research project in the country and since its inception in 1973, $15 million has been funnelled into the study. Most of the work on the project has taken place at the Technion under the aegis of Associate Professor Gedaliah Shelef of the Department of Environmental Engineering.

ALGAE: The unique aspects of this project are its intensive use of algae in the photosynthesis process, and its reliance on sunlight as the energy source in the production of oxygen. The project, known as the "Waste Water Reclamation and Algae Reproduction Project," includes four basic objectives:

☐ The elimination of environmental pollutants contained in sewage water from urban, agricultural and some industrial sources. This not only has health benefits but will also prevent the deterioration of natural water supplies through pollution. In the past ten years, 52 groundwater wells have been closed after being penetrated by waste-water containing dangerously high levels of nitrate content. In addition, because of Israel's tight water supply, too much water is taken from the underground sources. As a result, sea-water has seeped into the coastal aquifer, increasing the saline content of some wells and making them unusable.

☐ The application of reclaimed water to agricultural irrigation in order to release fresh water supplies for increased urban and industrial consumption. Today the agricultural sector consumes over 70 percent of the total national water supply. One of the major aims of water planning to reduce this unbalanced distribution of fresh water supplies. In addition to the use of reclaimed water, much research is being devoted to more efficient irrigation techniques and the development of more economic crops.

☐ The production of high-protein algae which can replace expensive fish and poultry feed. In Israel's relatively sun-baked climate (an average of almost 12 hours per day of bright sunlight in the summer, and between six and seven in the winter), the sun acts upon the algae in a photosynthetical process to produce substantial quantities of oxygen. The oxygen then decomposes the waste content in sewage, oxidizing the organic matter. Much of this is then reabsorbed by the algae, providing a vastly increased and protein-rich yield. Shelef estimates that algae can replace up to 50 percent of the soybean content of fishmeal, i.e. up to 150,000 tons per year. Soybeans, which cost $230 per ton, are imported for various commodities, including oil.

☐ The production of oxygen within the system itself. This factor is important for energy-poor countries because the infusion of external sources of oxygen requires a great deal of power.

PONDS: The reclamation process takes place in photosynthetic ponds of various sizes. Several experimental ponds have been built at the Technion. They are about 50 cm deep and divided into a number of channels. The chemical process takes place over a period of two days in the summer and eight days in the winter. The algae are then extracted from the water through flotation, and dehydrated for commercial use. The residue is then filtered out and the reclaimed water is ready for reuse.

The research portion of this joint Israel-German project is over. It has been found that the cost of reclaimed water for irrigation is about 20 cents per cubic meter (including the fixed cost of removing waste water from the local environment, which is about six cents per cubic meter). The cost of desalination is about 60 cents per cubic meter. Today, six cities are being considered as sites for the first large-scale implementation of this technique. They include Ashdod, Kiryat Gat, Beersheva, Nahariya, Acre and Beit Shean.

Two plants are already under construction – in Jamaica and Antigua – based on the Israeli scheme. According to a clause in the German-Israel agreement, all the equipment involved will be purchased from Israel. The project was financed by West Germany as part of its program for aid to underdeveloped countries. Other joint projects which include algae-based

water reclamation projects have been established in Thailand and Egypt.

In Egypt, Shelef says, conditions are even more promising for such a project. For one thing, there are more days of direct sunlight. For another, the concentration of population in a small area is so great that problems of sewage and waste disposal are even more critical. The Egyptians must protect the Nile River, the prime source of water for over 40 million inhabitants.

Shelef says that, until now, Egyptian and Israeli scientists have been able to share data and experience only indirectly, at international conferences. So far, there have been no direct contacts between the scientists of the two countries on this enterprise, which is so important for the future of both.■

Dan Izenberg