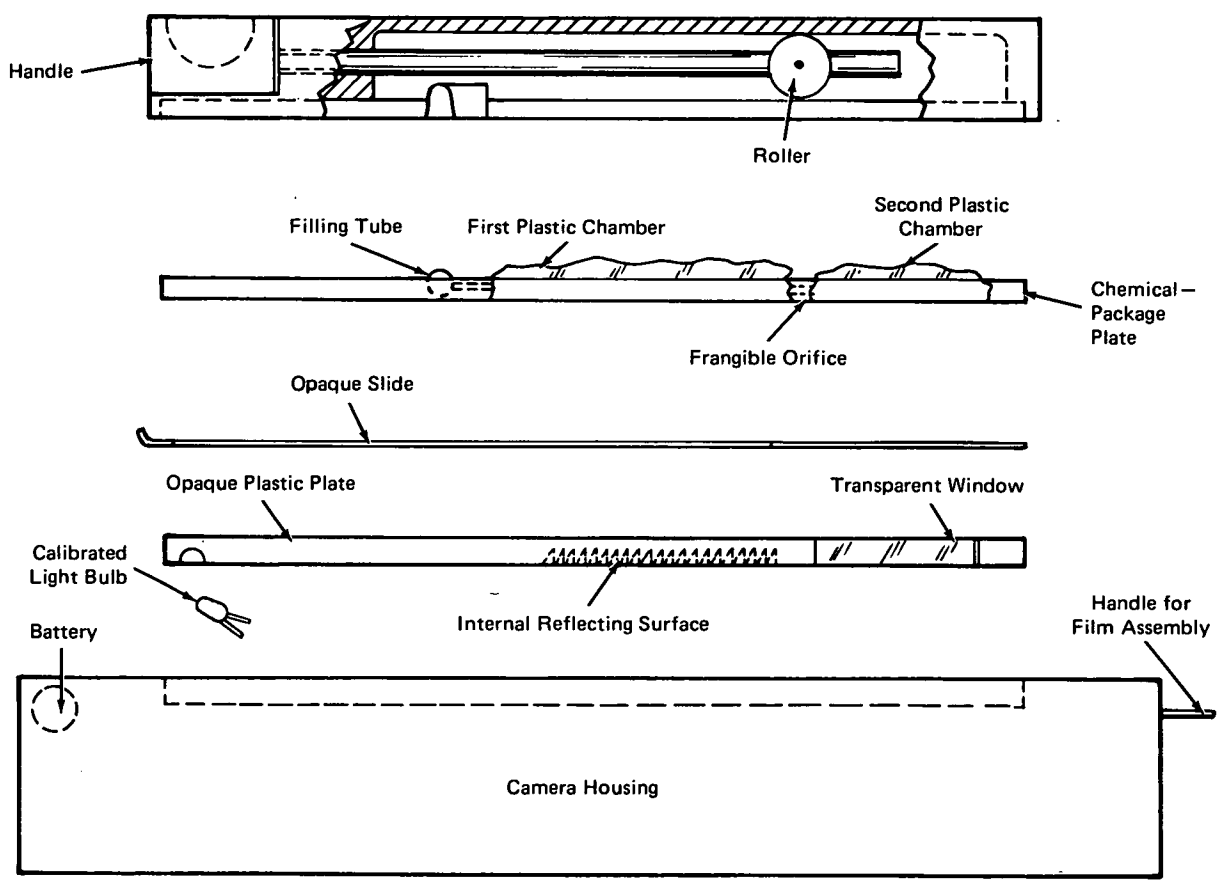
August 1973

B73-10222

NASA TECH BRIEF

Goddard Space Flight Center

Bacterial Contamination Monitor



Bacterial Contamination Monitor

The problem:

Drinking water and foods contaminated with bacteria have at one time or another immobilized or destroyed large human populations. Millions have died from cholera and typhoid fever and many have suffered from dysentery just from drinking contaminated water. Contaminated foods, on the other hand, have caused countless stomach disorders as well as cases of deadly botulism. As sanitation improved, the incidence of these diseases was sharply reduced to just a few isolated cases. However, their danger still exists. Today, many laboratories are using sophisticated equipment to detect bacteria in food and water intended for human consumption. This equipment, although effective, is not suited for field applications. Typically, it takes many hours to detect bacteria and then only by highly trained people.

(continued overleaf)

The solution:

An economical, simple, and fast method uses an apparatus which detects bacteria by photography.

How it's done:

The apparatus is designed to photograph a well-known chemical reaction which is used to detect the presence of living organisms. Specifically, all living organisms, including bacteria, contain adenosine triphosphate. This chemical reacts with luciferin and luciferase to emit light. The intensity of this light is directly related to the number of living organisms present in a given sample.

The apparatus shown in the figure contains a camera, a film assembly, a calibrated light bulb, an opaque plastic plate with built-in reflecting surface and transparent window section, an opaque slide, a plate with chemical packages, and a cover containing a roller attached to a handle. In use, the liquid sample to be tested is introduced into a filling tube located on the chemical-package plate. The tube is connected to a plastic chamber which contains a preselected quantity of butanol, magnesium, and water, all totaling to about 5 ml. This chamber is connected by a frangible orifice with a second plastic chamber which contains pelletized freeze-dried luciferin and luciferase.

After the sample is introduced, the chemical-package plate is placed over the opaque slide. The handle on the upper cover is then extended to its maximum excursion, and the cover is secured over the chemical-package plate. With the apparatus now assembled, the handle is slowly pushed forward so that the roller will squeeze the sample into the first chamber and then into the second by breaking the orifice. The entire contents are now in the second chamber which is located directly above the transparent window.

Given a short time, the chemical reaction will be complete, and if any bacteria are present, the mixture will emit light. At this point, the opaque slide is pulled out and the mixture is photographed with a 10-second exposure. Only one section of the film is exposed to the package. The remainder is simultaneously exposed to a battery-operated light bulb through a calibration wedge. The light path to the film frame is by way of an internal reflecting surface. This is done to determine light intensity due to background effects. The exposure is produced on a self-developing, 10,000 ASA Polaroid film. When the photograph is ready, it is compared with a standard chart which will indicate the amount of bacteria that causes the brightness level of the light reaction in the sample.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Code 207.1
Greenbelt, Maryland 20771
Reference: TSP73-10222

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,666,631). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel
Goddard Space Flight Center
Code 204
Greenbelt, Maryland 20771

Source: Edward Rich and Norman H. MacLeod
Goddard Space Flight Center
(GSC-10879)