APPLICATIONS OF CONDUCTIVITY CELL IN POLLUTION CONTROL

A K Garg, S Amrita Kaur and H S Virk

Department of Physics
Guru Nanak Dev University
India

The Conductivity Cell could be a useful tool in various fields. The design of such a cell and its various applications are discussed.

Key Words : Conductivity Cell, Micro-pore filter, Pollution, Bacteria

Introduction

Solid-state Nuclear Track Detector (SSNTD) technique is one of the most developed tools of research in a number of scientific and technological areas due to its wide range of applications in various interdisciplinary fields[1]. The first application that found widespread acceptance is the **nuclear track filter**[2]. The technique that led to the development of track-etched microfilter was discovered in 1962 entirely by Price and Walker[3]. The first commercially available filters were nucleopore microfilters made by Nucleopore Corporation[4]. Ion track filters offer distinct advantages over conventional filters which usually consist of fibres or porous foams and are ruled by several mutually dependent parameters. The main advantage of track filters is their welldefined pore size and uniform density[5]. The formation of fine hollow channels of controllable size along the paths of charged particles has created immense interest in biological applications of microfilters :

Separation of cancer cells from human blood,

and

Different types of bacteria and other damaging unwanted micro-organisms from liquids (especially natural water containing bacteria shaped like round balls, ie, staphylococci and bacteria shaped like rods, ie, colon bacilli).

Conductivity cell

To achieve our objective, we have designed and fabricated a **conductivity cell** having single pore membrane as partition between the two chambers as shown in figure 1.

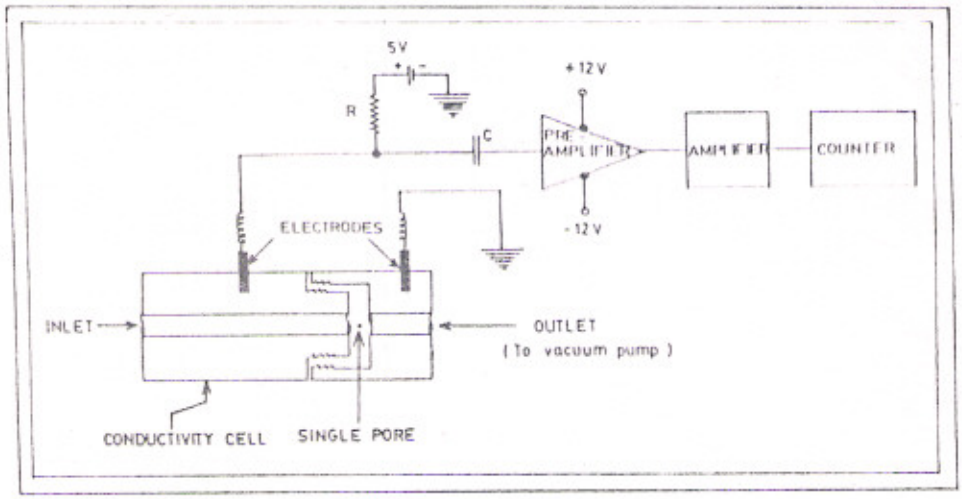

Figure 1 : Block diagram of Conductivity cell

Applications of the Conductivity cell :

Technological applications of the **conductivity cell** are given as under :

i) Separation of the cancer cells from human blood

The conductivity cell can be used to separate the cancer cells from human blood[6,7] with the help of microfilters making use of the fact that cancer cells are both larger and more rigid than normal blood cells. This also can be used to detect cancer cells in spinal fluid[8,9] and lung material sampled by needle aspiration biopsy[10]. The similar studies can be seen in immunology[11] and in the metabolic interactions[12]. In both studies, a membrane partition served as a barrier to cell migration but allowed free flow of metabolites, antibodies and antigens.

ii) Preparation of injections

Production of the injections in medicine needs various liquids free from contaminating particles larger than a few microns in size. The liquids and solutions can be filtered using the **conductivity cell** to ensure that they come to the standard of super pure reagent.

Clarification and stabilization of bacteria in wine and bear

One of the pleasurable qualities of this study is its demonstrated ability to clarify and stabilize wine and beer by removing bacteria, sediment and yeast. *Saccharomyces cerevisiae* (yeast cells) is often found in wine and beer. To make the beverage suitable for human consumption, yeast cells can be removed. This stabilization allows draft beer to be stored at room temperature, with no need for heating. Otherwise it would be required to destroy the bacteria in bottled beer by heating which is responsible for the difference in the taste between draft beer and the conventional bottled variety[4].

iii) Purification of industrial oil

This study can be used to purify the industrial oil free from solid components in order to minimize

the risk of electrical current break-through[13]. It is also used to obtain high quality aviation fuel for space rockets.

iv) **Determining the degree of bacteria pollutants in water samples**

Water is natural resource which is essential for a multiplicity of purposes. Its many applications include drinking and other domestic uses, industrial cooling, power generation, agriculture (irrigation), transportation and waste disposal. In the chemical process industry, water is used as a reaction medium, a solvent and a heat transfer agent. As a source of life for human beings and plants, it can't be replaced. Water contamination is a potential barrier of pathogenic micro-organisms and is one of the major cause for microbial diseases including cholera, typhoid, diarrhoea, malaria, yellow fever, polio, amoebic dysentery, gastroenteritis and filariasis, etc, in the developing countries.

One of the most ingenious and economical use of **conductivity cell** is to count the number of bacteria in a sample of polluted water. The number of bacteria can be counted using the resistive pulse technique which is a central tool in the flourishing field of flow cytometry. In contrast to optical observations which yield integrated data of ensembles of bacteria, the resistive pulse technique is based on the sequential observation of individual bacterium passing through a baffle[14]. The contaminated water (having different sizes of bacteria) will be made to pass through the micro-pore using the conductivity cell and thus the change in current flow will give an electric pulse. The number of pulses are counted to determine the contamination level in water sample.

Conclusion

The main focus of attention in the area of pollution is the need to control the concentration of bacteria in order to check the spread of several diseases. The **conductivity cell** designed can prove to be useful for various purposes other than determining the concentration of bacteria in water. Due to low cost, easy fabrication and simpler installation, the **conductivity cell** seems to be a viable tool for purifying the contaminated liquids. The cost of such programmes may be high initially, but is not at all unreasonable in view of the dangers caused by the use of these liquids. These studies will be helpful to check health hazards and for public safety.

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