

Microencapsulation

An Introduction

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In the 1950s there were two types of microcapsules.(1) One type is the National Cash Register (NCR) microcapsules for use at that time as carbonless paper (Fig. 1). These are thick-walled microcapsules prepared by the emulsification of printing oil into microscopic droplets followed by encapsulation within an impermeable gelatin-based wall. The main function of this type of microcapsule is to enclose the printing oil within impermeable "microscopic containers" that are applied to paper to form "carbonless paper." Pressure (e.g., writing) ruptures these microcapsules and releases the printing oil to form prints on the underlying paper.(2) At that time, I initiated a second type of microcapsules in the form of artificial cells (Fig. 1). Unlike the NCR microcapsules, each artificial cell consists of a spherical ultrathin semipermeable membrane enveloping biologically active materials. The ultrathin semipermeable membrane retains the contents, but allows external permeant materials to equilibrate rapidly to interact with the enclosed material. In this form, each artificial cell carries out its function while retaining the integrity of the artificial cell membranes.

In the 1960s, major research interests were mainly on the use of the NCR type of microcapsules in industry and pharmacy. They were used mostly as "microscopic containers" to prevent the contents from interacting with external environment, and to rely on rupturing of the microcapsule wall to initiate their action. During this time studies on the second type of microcapsule in the form of artificial cells were carried out only by us and later by two other centers.

With our demonstration of the feasibility of application of artificial cells in clinical applications and in other biomedical applications in the early 1970s there has been an exponential increase in research centers

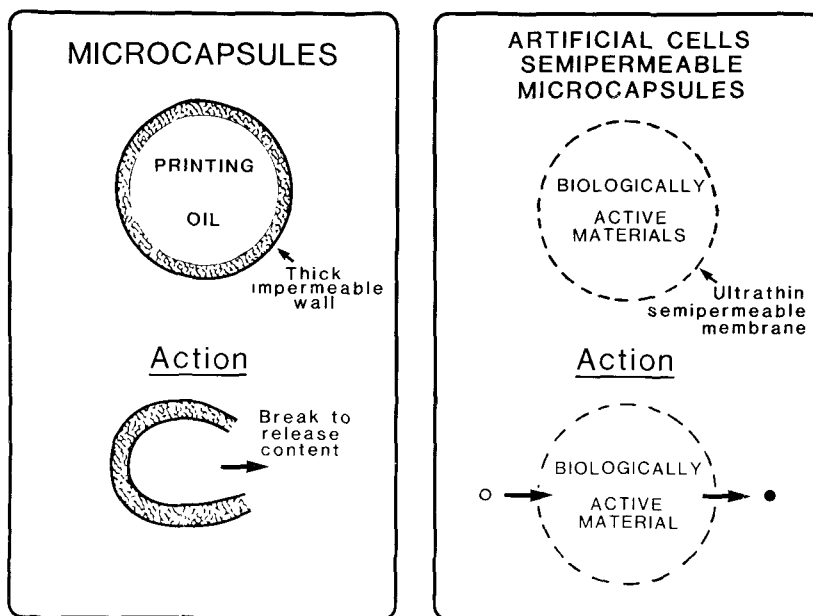


Fig. 1. Comparison of the NCR type of microcapsules (left) and artificial cells (right).

carrying out studies that made use of one or more aspects of the principle of artificial cells. Examples are the application of the principles of artificial cells in: (1) hemoperfusion for clinical applications in the treatment of acute intoxication, chronic renal failure, liver failure, and other conditions; (2) carriers for the delivery for drugs and other biologically active materials; (3) artificial red blood cell substitutes of different types; (4) the application of artificial cells in biotechnology for the immobilization of enzymes, biological cells and microorganisms. In the meantime, active research in the industrial and pharmaceutical applications of the NCR-type of microcapsule continues.

At present, many centers are involved in the different specialized areas of microencapsulation. There are ongoing international symposia, each concentrating on specialized aspects of "hemoperfusion," "liposomes," "drug delivery systems," "industrial applications," and other areas. The present 5th International Symposium for "Microencapsulation Including Artificial Cells" is an attempt to give an overview of the current status of the various specialized areas, with an emphasis on recent advances.

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