Chapter 18
Resealed Erythrocytes as Drug Carriers and Its Therapeutic Applications

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ABSTRACT

In this pharma innovative world, there are more than 30 drug delivery systems. Today's due to lacking the target specificity, the present scenario about drug delivery is emphasizing towards targeted drug delivery systems. Erythrocytes are the most common type of blood cells travel thousands of miles from wide to narrow pathways to deliver oxygen, drugs and nutrient during their lifetime. Red blood cells have strong and targeted potential carrier capabilities for varieties of drugs. Drug-loaded carrier erythrocytes or resealed erythrocytes are promising for various passive and active targeting. Resealed erythrocyte have advantage over several drug carrier models like biocompatibility, biodegradability without toxic products, inert intracellular environment, entrapping potential for a variety of chemicals, protection of the organism against toxic effects of the drug, able to circulate throughout the body, ideal zero-order drug-release kinetics, no undesired immune response against encapsulated drug etc. Resealed erythrocytes are rapidly taken up by macrophages of the Reticuloendothelial System (RES) of the liver, lung, and spleen of the body and hence drugs also. Resealed erythrocytes method of drugs delivery is secure and effective for drugs targeting specially for a longer period of time. This chapter will explain the different method of drug loading for resealed erythrocytes, their characterization, and applications in various therapies and associated health benefits.

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INTRODUCTION

The emerging new drug delivery technologies are likely to have significant and lucrative impact on drug industries. Drugs delivery assembly suffers various limitation including the amount of molecule delivered and parallel adverse effects. To improve the targeting of drugs a number of attempts has been performed through engineering the properties of the drugs carrier system (Dinda, 2013). The present scenario about pharmaceutical research is aimed to develop drug delivery system with lower side effects and maximum therapeutic benefit. The major desirable properties of a drug carrier is being selective to a target tissue as well as to protect the drugs from premature bio-inactivation. New emerging drug targeting strategies through improving carrier towards tissue exhibit maximal therapeutic index with minimum adverse effects. In diverse drugs carrier, the cellular carriers fulfill maximum criteria desirable in clinical applications. Various carrier are being uses as drug targeting; however, cellular carriers like erythrocytes, platelets, leukocytes, fibroblasts, hepatocytes etc. evidenced themselves to have greater potential over other cellular carriers (Hamidi & Tajerzadeh, 2003, Rossi et al., 2005). Erythrocytes are most common type of blood cells travel thousands of miles from wide to narrow pathways to deliver oxygen, drugs and nutrient during their lifetime (Pandey & Rizvi, 2010). Erythrocytes have good potential carrier capabilities for varieties of drugs and could efficiently deliver various drugs to selected target cells (Gothoskar, 2004). Drug-loaded carrier erythrocytes or resealed erythrocytes are promising for precise drugs targeting.

Resealed erythrocytes as carrier for drugs provides secure and more effective drug targeting for longer period of time and have advantage over several drugs carrier models regarding the biocompatibility, biodegradability without toxic products, inert intracellular environment, entrapping potential for a variety of chemicals, protection of the organism against toxic effects of the drug, able to circulate throughout the body, ideal zero-order drug-release kinetics, no undesired immune response against encapsulated drug etc. (Gothoskar, 2004). Loading of drugs in erythrocytes are performed through process of collecting blood, isolating erythrocytes from blood, entrapping drug of interest in the erythrocytes then followed by resealing the resultant erythrocytes carriers (Green & Widder, 1987). Drug loading process in erythrocytes and sealing of them is based on the response of erythrocytes under osmotic condition (Jain & Jain, 1997). Drug loaded erythrocytes or resealed erythrocytes are biocompatible with large drug loading capacity, biodegradable, non-immunogenic which could circulate for long periods of time (months) through circulation of blood and can be easily targeted to macrophages. In clinical trial, use of resealed erythrocytes was extensively investigated *in vitro* and recently validated *in vivo* also.

BLOOD

Blood is mobile connective tissue composed of fluid called plasma and cells have been extensively uses in pathologies and research laboratory. Blood have several functions including transport of oxygen to cell for aerobic respiration, nutrients, drugs, and excretes toxic substances generated endogenously. Circulating nature of blood makes it universal and primary sample for assessing several organ functions test. Blood have two major components as cellular component (erythrocytes, white blood cells and platelets) and the solvent of cellular component called plasma. Cellular component are again fractionated major cell RBCs and WBCs and platelets (Guyton & Hall, 2006). Blood is a tissue of mesenchymal origin with liquid matrix. The matrix in which the cells are suspended is termed as plasma. This plasma holds the