

Solution for Blood Shortages

Have you ever wondered what is done to blood after it has been donated? Donated blood is screened, tested, and stored for up to 6 weeks. If it is kept longer than 6 weeks it is considered outdated and can't be used for transfusions. Hemosol Inc. of Etobicoke, Ont. uses this outdated blood to make a product called Hemolink which is a red blood cell substitute that can be used for transfusions.

Blood consists of red and white blood cells, plasma, and platelets. The red blood cells contain hemoglobin which can bind and subsequently release oxygen. Hemoglobin, a protein, is a tetramer consisting of four parts each of which binds an oxygen molecule. In order to produce the Hemolink the red blood cells are first separated from the other components in the blood.

Secondly, the hemoglobin is extracted from the red blood cells and heated. The heat treatment ensures that no viruses remain that may have been overlooked in the screening process. Finally, all of the remaining proteins are removed including those which determine blood type (O, A, B, and AB). Therefore, Hemolink can be used for any person no matter what their blood type is. The purified hemoglobin is treated with a chemical that can form permanent connections between different parts of the protein. These permanent connections are called cross-links. The process involves oxidizing the sugar raffinose to create many reaction sites in the molecule. The oxidized raffinose is then added to the hemoglobin and the product is reduced to make the connections permanent. The cross-links help stabilize the hemoglobin molecule which in turn, improves the ability of hemoglobin to bind and deliver the oxygen. When cross-linked, the hemoglobin structure is stabilized and more than one hemoglobin molecule can join together. The larger hemoglobin complex can then circulate in the blood for a longer period. Hemolink circulates in the blood stream for a couple of days before it is excreted. This is shorter than transfused red blood cells (~ 1 month) but still enough to counteract oxygen shortages that occur during blood loss.

Hemosol is currently trying to make two types of Hemolink. One is frozen while the other is refrigerated as a fluid. Another version that they are trying to make is freeze dried! This would be useful for shipping because it is light weight. In order to use the freeze dried version sterile water would only need to be added!

Hemosol is currently conducting clinical trials of Hemolink in humans. Hopefully it will be available in the year 2000. Hemosol has hopes that Hemolink will avoid many of the problems of blood transfusions as well as blood supply shortages.

At the University of Toronto, Dr. Ronald Kluger and Dr. Andrew Grant (now at the University of Winnipeg) have developed a new patent called "Acyl Phosphate Esters and Modification of Proteins Therewith" which is licensed to Hemosol by the University of Toronto. With this patent, hemoglobin can be modified to produce cross-linked hemoglobin which will be used by Hemosol in hemoglobin-based oxygen carriers (HBOC's). Kluger has developed two other patents related to HBOC technology which are also licensed to Hemosol. It is hoped that cross-linking technologies developed by Kluger will be used to chemically modify hemoglobin to deliver therapeutic drugs and enhance treatment of cancer and infectious diseases.