

Development of a Portable Method for Preparing Previously Frozen Red Blood Cells for Transfusion

CHE Design IPRO 304C Project Plan

February 1st, 2005

Instructors: Professor Abbasian, Dr. Radovich

Team Members:

Senior CHE Members

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Other Members

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OBJECTIVE:

The objective of this project is to develop a system for washing multiple units of red blood cells (RBCs) to be used in an emergency situation. The major aspects of this system to be controlled will be: portability, minimum wash solution, minimum bio-waste, automation, and compliance with the standards necessary for transfusion. The goal of this project is to develop a theoretical design for a working system by the end of this semester.

BACKGROUND:

There is a significant need for blood glycerolization for medical personnel all over the world. Blood from organizations such as the American Red Cross and its local contributors can only be stored for a brief period of time, and there is limited storage capacity. However, if only the RBCs are stored and frozen through a process of glycerolization, the space requirement is reduced significantly and the shelf life goes from a matter of weeks to almost seven years. The freezing of RBCs without glycerol will cause hemolysis, but if they are first infused with glycerol, then hemolysis is almost

completely eliminated. The required storage capacity of the glycerolized RBCs is much less than that of whole blood.

The benefits of glycerolizing blood provide significant help for people needing blood in any crisis situation. If a catastrophe like the one on September 11, 2001 was to occur, hundreds of people in need of blood may not be helped because there would be an insufficient supply of blood and the available blood may not be transported to the locations quickly enough. It is difficult to ship large volumes of blood into disorganized and chaotic locations; thus, there exists a need for a portable device to convert glycerolized RBCs into usable blood for transfusions. Current equipment can be as compact as a commercial microwave (still fairly large), to as large and bulky as a washing machine. This presents a problem for transport into the field. An example of likely use is in a combat situation: If a soldier could receive a transfusion in the field from glycerolized RBCs processed by a portable unit instead of having to be taken to a hospital where blood is available or having medical personnel carry whole blood into the field, then lives could be saved.

METHODOLOGY:

- Evaluate problem
- Determine situation for use
- Obtain information about the deglycerolization of red blood cells (RBCs)
 - o Is there an already existing technology?
 - o Can we modify it to meet our project specifications?
- Split team into 3 initial research groups:
 - o Technologies
 - Centrifugation – Group 1
 - Membrane Filtration – Group 2
 - o Standards/Protocol – Group 3
- Present information to team and pick the most efficient technology
- Using the selected technology, obtain more information/research to design a deglycerolization process that meets:
 - o All FDA and OSHA requirements
 - o Already existing protocol standards
- Key design:
 - o Portable
 - o Easy to use, automated
 - o Inexpensive
 - o Small, light-weight
 - o Minimal power requirements
 - o Robust
 - o Minimal washing-fluid requirements
 - o Minimal bio-waste
 - o Recyclable components
- Accumulate sufficient research for a continuing IPRO

SCHEDULE OF TASKS:

Deadline	Tasks	
Jan18	Introduction to the IPRO.	
Jan 20	Gain an understanding of the project and determine goals for the project	
Jan 25	Team divided into three groups:	
Centrifugation group	Membrane filtration group	Standards group
Derek	Eric	Clara
Karen	Jen	Oscar
Ahlam	Suman	Joe
Brogan	Clara	Venkata
Joe	Dave	
Venkata	Oscar	

IKNOW system: Clara

Members of the group volunteered to write different sections of the project plan.

- Background: Brogan
- Tasks: Suman, Clara
- Objective: Jen
- Methodology: Karen

Feb 01

Feb 03

Feb 04

Finalize Project Plan

Feb 08

Feb 10

Feb 15

Feb 17

Feb 22

Select technology to be further used

Feb 24

Assign new groups as necessary

Mar 01

Mar 03

Mar 05

Outline Midterm Progress Report

Mar 08

Mar 10

Mar 22

Mar 25

Mid-Term Progress Report

Mar 29

Apr 05

Apr 07

Apr 12

Finish Final Report

Apr 14

Finish Presentation

Apr 19	
Apr 21	Practice Presentation
Apr 23	Final Report
Apr 25	Poster and project abstract
Apr 27	Oral Presentation
May 03	I PRO Day
May 06	Team information and Comprehensive Deliverables CD
May 09	I PRO Survey