Tohoku Univ. Technology

Blood Compatibility Testing System

A Low-Shear Platform for Reliable Blood Compatibility Assessment

Overview

Hemolysis testing in accordance with standards such as ASTM F1841 evaluates whether blood pumps and circulatory support devices cause excessive red blood cell damage. However, circuit-induced shear stress may confound the assessment of device-related plasma protein damage, particularly von Willebrand factor (VWF) degradation.

The system incorporates two features:

Volume-adjustable reservoir bags: Compensate for pressure fluctuations during repeated blood sampling to maintain consistent test conditions.

A smaller-diameter resistance tube: Provides the required circuit resistance through distributed pressure loss along its length, helping avoid localized shear stress concentrations.

Together, these features aim to maintain low shear stress within the test circuit and support reproducible blood compatibility assessments under defined pressure and flow conditions with a small blood volume.

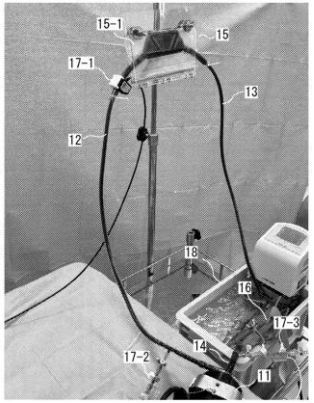
Applications

- Hemolysis and VWF testing of blood pumps and ECMO circuits
- Research toward patient-specific device selection and settings

IP Data

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Test Circuit Configuration and Data



Component
10 Blood compatibility testing system
11 Blood pump
12 Tubing
13 Resistance tube
14 Connector
15, 16 Reservoir bags
15-1 Reservoir volume adjusters
17-2 Flow sensor
17-1, 17-3 Pressure measurement ports
18 Temperature-controlled bath

Figure: Schematic configuration of the test circuit

Parameter	Condition 1	Condition 2	Condition 3
Pump speed (rpm)	2,000	2,500	3,000
Flow rate (L/min)	4.0	5.1	6.2
Inlet pressure, Pin (mmHg)	5	5	5
Outlet pressure, Pout (mmHg)	95	144	202

The pump inlet pressure remained at 5 mmHg across the tested operating conditions, confirming that negative inlet pressure did not occur.

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