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Development of a Conductometric Sensor to Approximately Estimate the Plasma Osmotic Pressure of Blood Using a Novel Glass-Bead-Based Blood Cell Filter

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A conductometric sensor for approximately estimating the plasma osmotic pressure of blood has been developed. The sensor was designed to spontaneously absorb blood upon contact, then separate plasma by adsorbing blood cells, and finally measure the conductance of the plasma using built-in electrodes. This sensor used a blood cell filter made up of a number of glass beads. The diameter of the glass beads was 0.063–0.088 mm, which was one order of magnitude larger than that of blood cells, so that the adsorbed blood cells on the beads did not prevent further blood flow through the space between the beads. We used preserved horse blood to evaluate this sensor. The filter successfully absorbed test blood and provided plasma to the measurement element in the sensor. An alternating voltage (10 mV (pp), 1.5 kHz) was applied between the built-in platinum electrodes and the corresponding current was measured simultaneously to calculate the conductance of the plasma. The sensor output was independent of hematocrit from 20 to 40% and exhibited a linear relation to plasma osmotic pressure from 360 to 460 mOsm/L. The osmotic pressure was artificially controlled by NaCl.

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