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Feature articles: Latest trend in the application of SQUID - Development of liquid phase immunological test system using magnetic marker

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In the medical tests such as blood test, it is generally called immunological test to detect biomaterials such as protein due to disease and bacillus using antigen-antibody reaction. In these tests, type and volume of the biomaterials are detected using test antibody that selectively combines with the biomaterial (antigen). The antibody is marked with a marker and the binding reaction is detected by measuring the signal from the marker. Although optical tests using optical markers are adopted at present, the magnetic test using the magnetic markers of nanometer size is attracting attention as a substitute for the optical test.

The magnetic test has two significant features that optical test does not have. One is that the magnetic markers can be assumed to be fine magnets, and the signal is a vector quantity with magnitude and direction. By combining this property with the Brown rotational motion, the test in liquid phase without washing process is made possible. The washing process is indispensable for optical method. Since the "washing process" requires much labor and time, elimination of this process enables quick tests. The other feature is that non-transmitting materials can be tested, and testing with whole blood and diagnosis in the body is being investigated.

Fig.1 shows schematic diagram of the liquid phase immunological test that we are developing. Fixing antibody is set on the surface of the polymer particles of about a micrometer, to which antigen combines. After combining, the magnetic markers for detection are fed and a part of markers combine, forming bound markers, and others remain as unbound (free) markers. While the free markers exhibit high speed Brown rotation, the bound markers rarely rotate. As a result, the magnetic characteristics of the two greatly differ so that they can be identified without using the "washing process."

Fig.2 is an example of detecting a protein called IgE using this method. The abscissa axis stands for the volume of IgE, and the ordinate axis stands for the magnetic signal detected by SQUID. The figure shows that there is a good correlation between the volume of IgE and the detected signals, which indicates that detection at attomole level is possible. The results of the solid-phase detection using normal "washing process" are shown for reference. It is seen that the same results are obtained by the two methods.

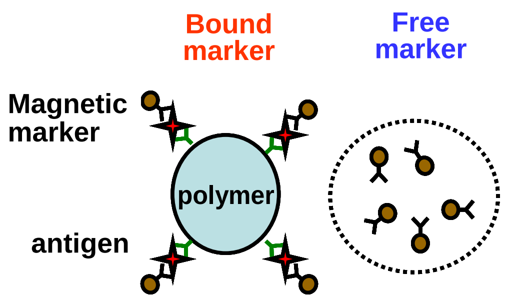

Fig.1 Liquid immunological test using solid polymer beads

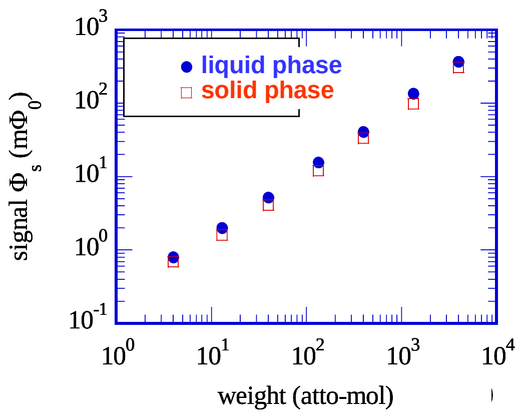

Fig.2 Detection of protein (IgE)

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