Separation of ink using micro ultracentrifuge

Hitachi preparative micro ultracentrifuge CS150GX II and S140AT angle rotor

Pigments contained in ink have become increasingly microparticulated as small as a few nanometers in diameter in tandem with the recent technologic advances. A normal centrifuge whose RCF is several tens of thousands of x g cannot sediment such nanometer-size particles sufficiently.

We have a micro ultracentrifuge rotor offering the world's highest RCF 1,050,000 x g. Our calculations show that 10-nm particles can be sedimented within two hours by using this rotor under the assumed conditions (particle density: 1.05 g/ml, particle configuration: perfect sphere, separation in distilled water).

Following is our experiment report on separation of black ink by means of this rotor.

Experiment

1. Separation using the preparative micro ultracentrifuge
   Centrifuge: CS150GX II preparative micro ultracentrifuge
   Rotor: S140AT angle rotor (2 ml x 10 tubes)
   Tube: 2PA seal tube
   Speed: 140,000 rpm
   Maximum RCF: 1,050,000 x g
   Time: 3.5 hours
   Temperature: 20°C
   Sample: Black ink No. 1 and 2

2. Result

![Supernatant](black_ink_no1.png)  ![Sediment](black_ink_no2.png)  ![Supernatant](black_ink_no2.png)  ![Sediment](black_ink_no1.png)

Black ink No. 1  Black ink No. 2
3. Explanation

The sizes of the particles sedimented in the above experiment are assumed to be between 6 and 10 nm for both the black ink No. 1 and 2. It shows effectiveness of the ultracentrifuge in separation, sedimentation and concentration of nanometer-size particles.

Although the sample amount was low because the 2-ml tubes were used in the micro ultracentrifuge this time, the preparative ultracentrifuge can separate about 162 ml of sample (13.5-ml tubes) at a time.

[ Conditions for centrifugation ]

- Instruments: CP-WX series preparative ultracentrifuge and P70AT2 angle rotor
- Tube: 12PA seal tube
- Speed: 70,000 rpm
- Maximum RCF: 452,000 x g
- Time: 24 hours