1. INTRODUCTION

A dielectric liquid in EHD (Electrohydrodynamic) pump is driven directly by an electrical force. In biotechnology or medical technology, it will be a promising micropump which is a simple system and electrically controlled.

Two well-known electrical forces, ion-drag force and electrostriction force, are involved with an EHD flow. Since higher EHD pumping pressure can be obtained in ion-drag phenomenon, we have investigated it with a needle point vs. cylindrical electrode system. However, for a long term operation, the corrosion at the needlepoint will make the insulating liquid contaminated.

The aim of this investigation is to generate an EHD flow by the electrostriction force. To make an electric field distribution, a spherical-cylindrical electrode system and a slightly conductive liquid medium are employed in our experiments.

2. EXPERIMENTS

The schematic diagram of the experimental apparatus is shown in Fig.1. The electrode system is inserted middle of a plastic tube, polyvinylcholoride, with inner diameter of 5 mm. Two kind of the flow media are examined pure Si oil of 50 cSt in kinematic viscosity, and Si oil added buthylalchol, BA, for giving it slight conductivity, with BA concentration of 2, 4, 6, 8 wt%. The EHD effect is measured by the liquid column height, \(2h\).

3. RESULTS

The dependency of the liquid column height on the applied voltage is shown in Fig.2. The EHD effect with BA is much higher than that of pure Si oil. The higher concentration of BA, the higher liquid column height is obtained, below the concentration of 6 wt%. Over 6 wt% the EHD effect is suddenly dropped.

The relation between the current and liquid column height is shown in Fig.3. The efficiency of the EHD is higher in buthylalcohol concentration of 2-6 wt% than those the pure Si oil or Si oil added 8 wt% BA are used. Among them the highest efficiency is obtained with 2 wt% BA. Since little current is required to produce high EHD effect, it is suggested that flow medium of Si oil added 2-6 wt% is driven by electrostriction force.

The EHD effects of two pure Si oils which have different conductivities are compared in Fig.4. When the conductivity becomes 30 times large, the EHD effect becomes 5 times large.

4. CONCLUSION

In this report it is clarified that the EHD effect strongly depends on the conductivity of the flow medium. This suggests that the difference of EHD effect on the concentration of BA is due to the difference of the conductivity. Further investigation should be done not only on the dependencies of the conductivity but also of the charge carrier species.