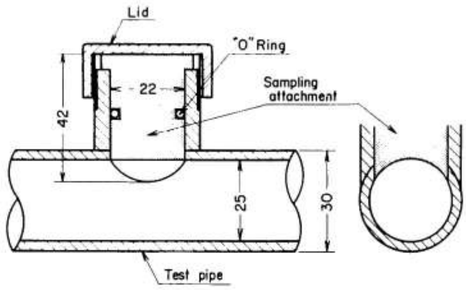


Fig. 4 Cross-sectional view of removable attachment for measuring gravity effect in turbulent flow

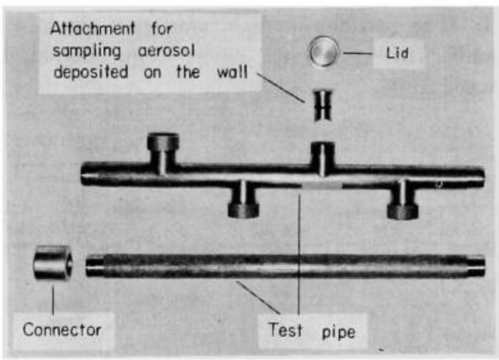


Photo. 1 Test pipe elements with and without removable attachments

to the filter holder was mounted on metallic stands.

The flow rate was measured with a float-type flow meter. The experiment was performed with flow rate ranging from 3 to 520 l/min.

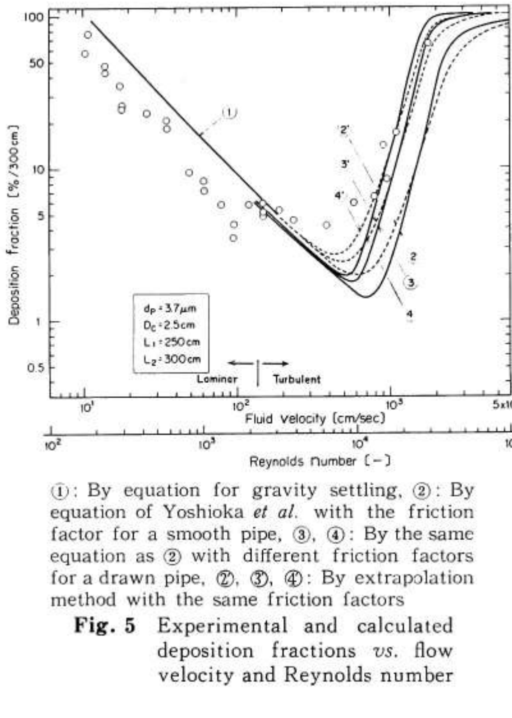
The amount of aerosol deposited in the pipe and the filter was determined from measurements by fluorescence photometer of the concentration of uranine methylene-blue washed out with purified water.

The deposition fraction on the test pipe was obtained as the percentage of deposition in the test pipe in reference to the total deposition in the system* (*i.e.* the test pipe plus filter).

IV. Results and Discussion

1. Deposition Fraction *vs.* Flow Velocity and Reynolds Number

The experimental results obtained on the deposition fraction *vs.* the flow velocity and Reynolds number are shown in **Fig. 5**, together with the calculated curves for the particle diameters $d_p=$ 1.8 and 3.7 μm, pipe diameter $D_c=2.5$ cm, regulating pipe length $L_1=250$ cm and test pipe length $L_2=300$ cm. In the calculation, Sehmel's value of 1.4 g/cm^3[12] was taken for the density of the uranine methylene-blue particles. As seen in Fig. 5, the trend of variation of deposition fraction with the flow velocity is similar to that predicted by calculation. In the laminar region, the calculated values are 1.5∼2 times higher than those determined from the present experiment.



①: By equation for gravity settling, ②: By equation of Yoshioka *et al.* with the friction factor for a smooth pipe, ③, ④: By the same equation as ② with different friction factors for a drawn pipe, ②', ③', ④': By extrapolation method with the same friction factors

Fig. 5 Experimental and calculated deposition fractions *vs.* flow velocity and Reynolds number

At the transition ($Re\approx 2{,}000$) from laminar to turbulent region is seen a sudden change in the deposition fraction. This could be attributed to the application at this juncture simultaneously

* To take account of the deposition in the regulating pipe set upstream of the test pipe, the true deposition fraction of the aerosol in the test pipe should be determined as follows.

If the lengths of the regulating and the test pipes are L_1 and L_2, and the deposition fractions in the lengths L_1+L_2 are $F(L_1)$, $F(L_2)$ and $F(L_1+L_2)$, respectively, the fraction corresponding to L_2 is expressed by

$$F(L_2)=\frac{F(L_1+L_2)-F(L_1)}{1-F(L_1)}. \qquad \text{(A1)}$$