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Completion of Super-high Turbidity Meter by optical fiber method

New model introduced here is a Super-high Turbidity Meter, Model COMPACT-HTW, with new sensor using an optical fiber. The maximum measuring range in a conventional turbidity meter is usually about 2000ppm and, even by a “high turbidity meter”, the maximum range is limited below 20000ppm. But the new model is able to measure concentration up to 70000ppm. This instrument has been developed to satisfy the requirement on measuring high turbid river in China. And similar demand arising in Japan. It has been put into market as a member of our standard COMPACT series since October, 2004.

COMPACT-HTW

Optical-fiber type infrared back-scattering turbidity sensor

To measure turbidity, there exists permeability method of underwater light, dispersion strength method (front, right angle, back) and integrating-sphere method. Each one has merits and demerits. It has been judged that the back-scattering method is more advantageous than others, because the optical transfer path is the shortest in turbidity measurement. Moreover, our development has been supported by Mie theory (Mie 1908). The linearity obtained at super-high concentration field is consistent with sampled natural water in which various size of suspended particles are mixed. At our development stage, it was a technical breakthrough to shorten optical transfer path in water for an infrared back-scattering method. In order to shorten the optical transmitting path, the substrate LED emitter and photodiode receivers that have mounted below the lens of sensor in conventional probe are instead installed on interior PCB and all transmitting routes are through optical fibers, as shown on the schematic drawing of Fig. 1. The Fig. 2 shows the optical surface of new sensor. In the central part, a receiving optical fiber is for back-scatterring light and eight emitting optical fibers are in circle array. Besides, in order to completely intercept the stray light from the luminescence section, receiving portion is isolated by a shading tube. Those optical fiber bunch are processed with resin mold, which we specialize in, and maintained watertight completely. With above ideas and technologies, the optical transfer path becomes less than a few mm and it enables to measure super-high concentration.

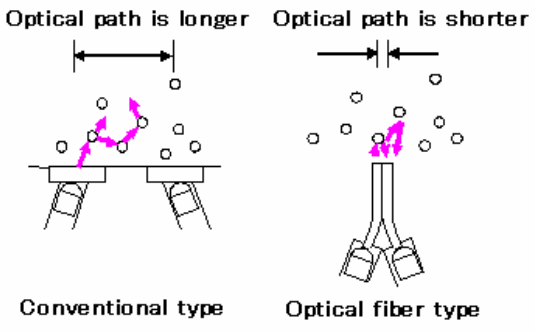

Fig1 .Schematic diagram of optical fiber sensor

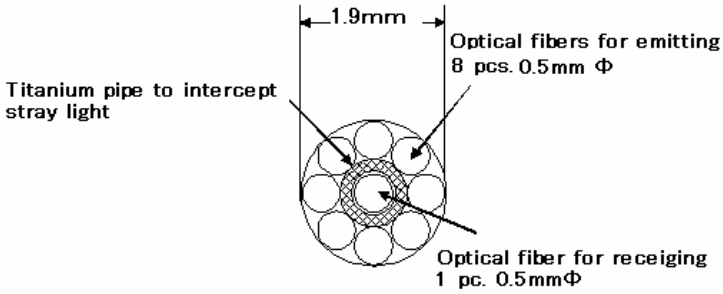

Fig.2 Drawing of optical fiber sensor surface

COMPACT-HTW on product line

With Newly-developed turbidity sensor equipped in ordinary COMPACT data logger, and wiper, this model, COMPACT-HTW is currently on product line. So far as an available turbidimeter is COMPACT-CLW combined with chlorophyll sensor. But hereafter we will take COMPACT-HTW as an exclusive turbidimeter. Since COMPACT-HTW, however, is an exclusive super-turbidity instrument, please pay your attention that it is not to be suitable for the measurement in low concentration area of ocean. (Preliminary announcement : In quite near future, an exclusive super-low turbidity meter will be introduced, which ensures to measure at range of 1/100ppm.)

Test data

Fig. 3 shows the result of Kaolin concentration experiment, exceeding the saturation point, in order to prove the characteristic of COMPACT-HTW. Although the saturation point was extended up to 120,000ppm approximately, we set maximum 70,000ppm for practical range. Fig. 4 represents the examination of SS calibration. The bottom mud that was dried, scooped up from Yangtzu river and here are filtrated uniformly by a 50-micron mesh. It is verified from the graph that the sample mud in concentration of 70,000ppm is considerably equivalent to 14,000ppm
in Kaolin index and this instrument ensures relative deployment.
(Remark : As SS conversions differ at each site, it is necessary to make a calibration curve every deployment.)

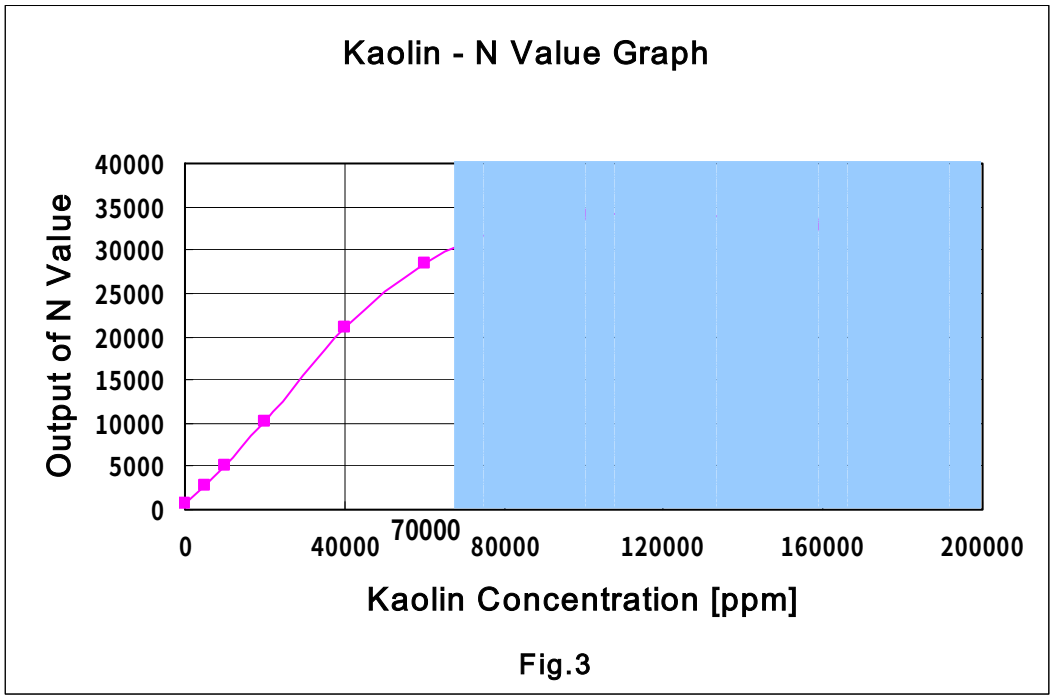

Fig.3

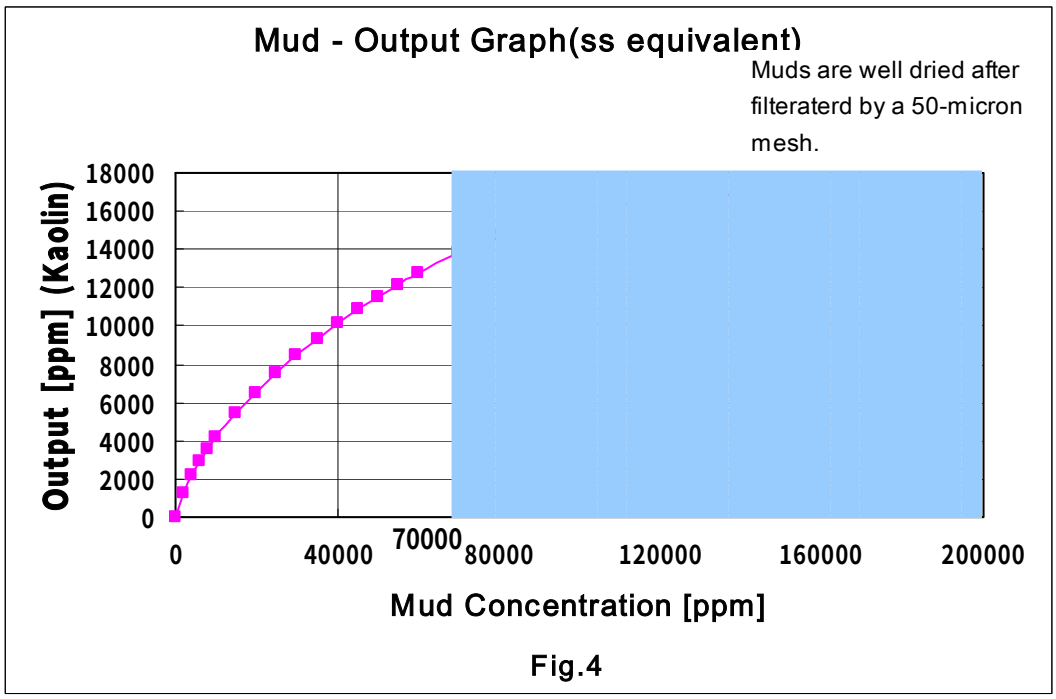

Fig.4