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## 1. Introduction

The efficiency of sludge treatment and water treatment in sewage plants depends heavily on optimal chemical dosing ratios and stable operation, conditions which cannot be achieved without the accurate and reliable monitoring and control of the sludge density. Thus, highly reliable sludge-density meters will become increasingly important in the future.

Measuring instruments of various types have already been adopted as sludge-density meters, including the ultrasonic wave type, the near-infrared light type, and the microwave type. Each has its own merits and demerits. The most variable factors are the effects of the sludge color, bubbles, and adherent sludge on measurement performance. Other points of difference include maintainability, price, restrictions on applicable density ranges, and the ability to produce output in real-time (continuously). Overall, however, the state of the technology is poor: most sludge-density meters in use fail to satisfy users and are riddled with unsolved problems.

Fortunately, JFE Advantech has recently developed the SD-40, a dual scattered-light sludge-density meter without the usual flaws of other models. With help from the properties of near-infrared light, the SD-40 produces stable measurements even when sludge bubbles, adheres to the device, and varies in color. The SD-40 measures sludge of low to high densities continuously, in real time.

## 2. SD-40 Type Dual Scattered-Light Sludge-Density Meter

### 2.1 Product Outline

The SD-40 type dual scattered-light sludge-density meter is configured with multiple dual-wavelength light sources in a detecting module. These light sources allow the device to automatically correct the effect of optical scattering.

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scattered-light type (the new dual light type) and single scattered-light type (the conventional single light type). **Figure 3** compares the performance of the two measurement devices.

In the case of a moderately bright sludge, both measurement devices showed good linearity and output measured densities that agreed well with the densities analyzed manually. The moderately bright sludge used in the experiment is approximately similar to general raw sludge, excess sludge, return sludge, and thickened sludge.

Once a thickened sludge putrefies, it darkens considerably. This type of thickened sludge usually corresponds to the 'dark sludge' classified separately from digested sludge in sludge treatment facilities and the like. The dual scattered-light type had good linearity in sludge

### **3. Performance of Product**

#### **3.1 Performance Related to Changes in Sludge Color**

The densities of three types of sludge of different colors (properties) were gradually adjusted in steps by adding clean water. The actual densities were determined at each stage by manual analysis, and the measured densities were determined by offline analysis using a dual

measured by the SD-40 type dual scattered-light sludge-density meter without the cleaning operation by flushing water. Only a small amount of sludge adheres to the surface of the detecting part against which the sludge collides, when the detecting part is disposed in the sludge flow direction. The self-cleaning effect is thereb