

## Q&A

### **12Q8: Can I utilize the "ultrasonic sound technology" for controlling the algae? (Ms. C.N. Thailand)**

**A:** We could not find some cases on actual use of ultrasound technology for controlling the algae in the lakes and reservoirs in Japan. However, there is a report on the experiment. We translated it into English under the responsibility of WaQuAC-Net.

The report title: "The measures for inhibiting water bloom\* in a reservoir by using ultrasound device.

Organization which conducted the experiment: Japan Water Agency (JWA)

Conference which the report was presented: National Conference of Japan Water Works Association (JWWA) in October, 2017.

Result: Through the experiment, they confirmed the effect of inhibiting water bloom by ultrasound method.

\* Water bloom is called AOKO in Japanese. It is the situation that plankton increases remarkably and spreads, and the surface of water in a lake and reservoir is covered in special blue green color. It is caused by Microcystis and Anabaena mainly.

Ultrasound method is supposed that it is useful for inhibiting AOKO in a shallow lake and reservoir. On the other hand, circulated aeration method, which is popular for inhibiting algae in Japan, can be used effectively in 15-20m depth lakes and reservoirs. The following is an abstract of the report on the inhibition of water bloom in a reservoir by using ultrasound device.

#### **1. Background**

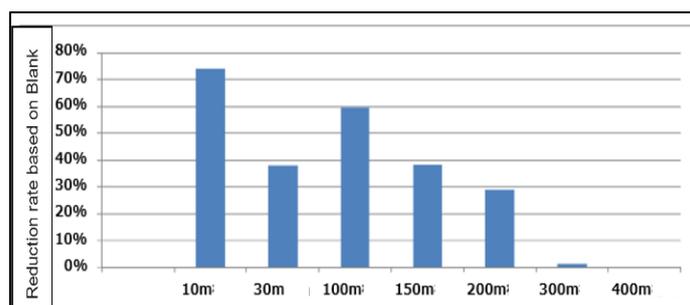
Landscape disturbance and moldy odor problem have occurred due to abnormal growth of blue-green algae in the dam lakes where eutrophication has progressed. As the measures, circulated aeration method has been widely applied in Japan. To apply it effectively, however, it is necessary to ensure the circulation layer of 15m to 20m around. In a shallow lake, it is difficult to use circulated aeration method. Japan Water Agency (JWA) has been conducting experiments of shading method or drying method for shallow lakes. This time, as the new measures, experiment using the ultrasound technology method was conducted against water bloom. We report the result.

#### **2. Principle of ultrasound method**

Ultrasound device used in this experiment transmits ultrasound waves of low frequency (23~50 KHz) from the tip. It causes resonant oscillation of algae cells and vacuoles in cells. It can damage gas bubbles and cell membranes. And then, the growth ability of algae is inhibited by destroying the vacuolar membranes. Operating the ultrasound device at the early stage of algae growth can prevent algae from floating accumulation.

### 3. Experiment using small glass water tanks

- 1) To verify the capability of ultrasound device, an experiment using a small glass water tanks (90L x 33W x 18H cm) was carried out.
- 2) Conditions of the experiment: The glass water tanks were set beside the window. Room temperature was 28°C. Output of the ultrasound device was set to be effective even at the points of 30m to 400 meters away.
- 3) Control group without ultrasound device was also tested as controlled experiment (blank) to clarify the effects of ultrasound irradiation.



**Figure1 Relationship between corresponded distance for ultrasound output and reduction rate of Chl-a\***

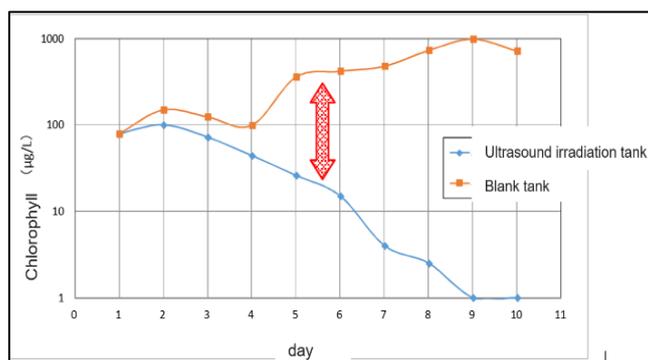
After 5-7 days-ultrasound irradiation, the reduction ratio (the reduced Chl-a\* concentration with irradiation compared to the Chl-a concentration in blank) is showed in Figure1. Irradiation distance within 200m was verified as effective distance.

\*Chl-a: chlorophyll a

### 4. Experiment at the compartment which was made in the dam lake

The dam lake which used for the experiment was constructed for water supply with a total water storage volume of 10,000,000 m<sup>3</sup>, a flooded area of 808,000 m<sup>2</sup>, a water depth of about 21.6 meters. The water quality of the dam lake is no good and AOKO occurs easily, because the dam lake takes water from the downstream of the Tone River. To

carry out the compartment experiment, two large water tanks (3 m × 3 m × 2.5 m) enclosed by the seat and completely separated from the dam lake water were installed; one tank for the test, and the other for the control (blank). And ultrasound irradiation was implemented for 10 days at the large test water tank. Two large water tanks were observed. The device is solar power type with little running cost. The change of the concentrations of Chl-a in the compartments during the experiment period is shown in Figure 2.



**Figure2. Change of Chl-a concentration**

The tank with ultrasound irradiation had significantly different from the control tank in the day 6. On the 8th day, it was confirmed that almost algae in the tank with ultrasound devices died and settled down.

## 5. Conclusion

The inhibition effect of water bloom by using ultrasound device was confirmed through the experiment. As future study, we are planning to experiment whether ultrasound method can inhibit the water bloom which produce color, moldy odor, fresh water red tide and so on in specific area such as a cove where circulated aeration method does not work effectively.

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