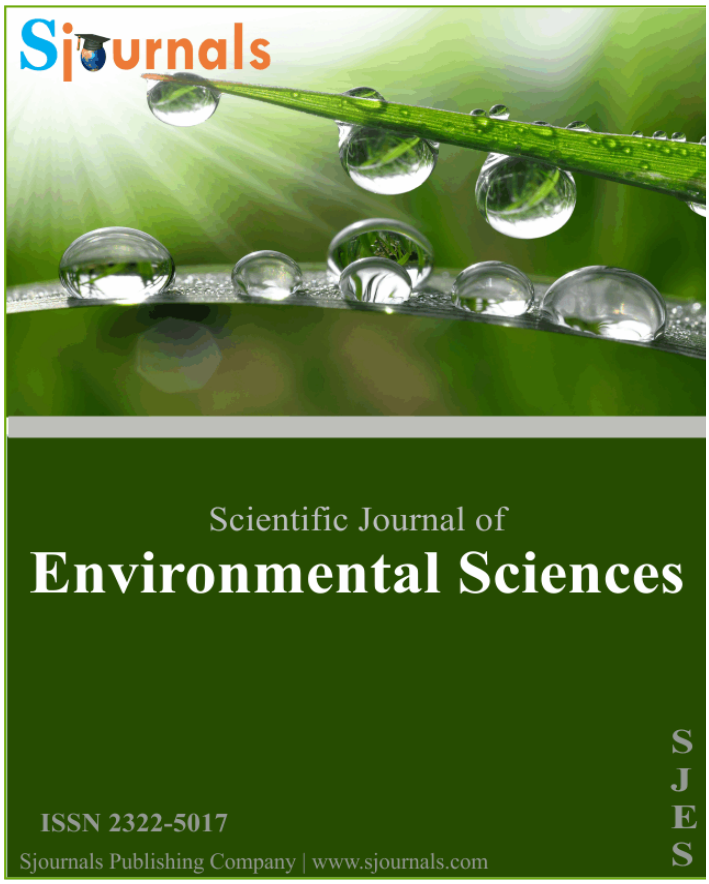

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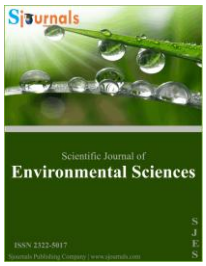

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Original article

Evaluation of photo-oxidation effect using TiO_2 coated EPS (expanded polypropylene) in the stagnant stream channel

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ABSTRACT

The photocatalyst is not directly applied to the water, because the form of nanoparticle. In this study, we developed a photo-oxidation ball to the improvement of water quality in stagnant water. And we used real-time monitoring data of chl-a to verify the water purification ability of developed balls. TiO_2 coated EPS balls were applied to the stagnant channel. We monitored during the algae bloom period. As a result, we could be confirmed that chlorophyll-a was decreased in the installation places the ball during the daytime. However, at night, chlorophyll-a was increased. Algae control by the photo-oxidation balls in the open space was more of a growth inhibition than a remove.

1. Introduction

Algae blooms refer to the increase in biomass of algae due to increased growth or due to physical aggregation, leading to an above normal accumulation and generally adverse ecosystem effects (Glibert, 2016). In particular, the stagnant waters in the stream tends to concentrate the pollutants because the water flow stands. So, algae blooms occurs with very high frequency at the stagnant stream channel. We have developed to TiO_2 coated balls for control the stagnant water quality. Photocatalytic oxidation processes have been widely

considered as powerful methods to remove non-biodegradable organic pollutants in water (EL-Mekkawi et al., 2016). In this study, chlorophyll-a has been selected as indexes of an algae blooms. We analyzed the effect of TiO_2 coated EPS balls using a real-time data of chlorophyll-a.

2. Materials and methods

We conducted the experiments in the stagnant stream (Hallyu stream in Goyang city, Korea). In Hallyu stream, non-point sources was input during the rainy period, and water quality was severely deteriorated. So, algal blooms occurred during the sunny period. A chlorophyll-a monitoring sensor (Algae-check, modern water, UK) was installed (St. 1 = stagnant areas in stream, St. 2 = area of TiO_2 coated balls) (Fig. 1). The chlorophyll-a was measured every second in the water surface. This measuring equipment is portable fluorometer. Fluorescence is the emission of light by a substance that has absorbed light. The intensity of the emitted light provides the concentration of the target compound.We analyzed the effect of photo-oxidation reaction through the collect real-time data.

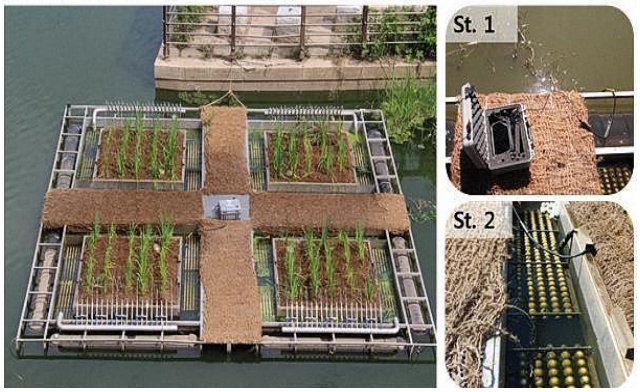

Fig. 1. The station of investigation.

3. Results

The chlorophyll-a concentration in the Hallyu stream showed a pattern rising from 14:00 and it has gradually decreased at around 16:00 (Fig. 2). Otherwise, chlorophyll-a concentration in the installed area of TiO_2 has decreased during the day time (Fig 3). But, night-time did not have any effect because there is no light (especially ultraviolet). And stagnant areas in stream and night-time of TiO_2 coated balls showed the same pattern. This means that the chlorophyll-a reduced by the photo-oxidation effect. Although photo-oxidation effect was occurred in the area of TiO_2 coated balls only day time. It was able to confirm that it is possible to continue to inhibit the growth of algae during the day time.

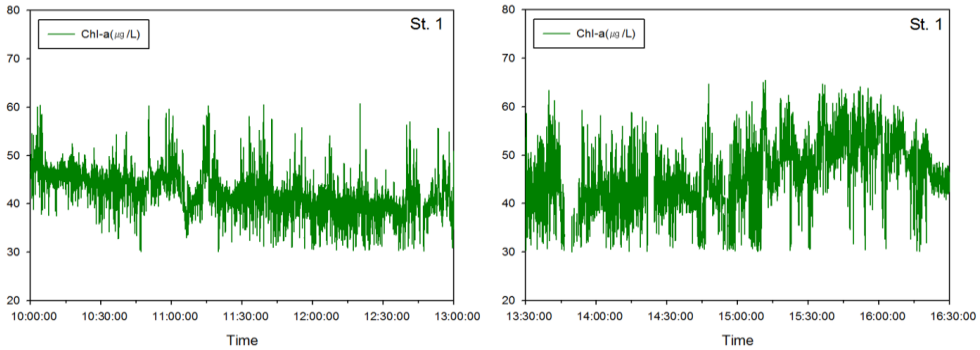

Fig. 2. Chl-a real-time data in the Hallyu stream.

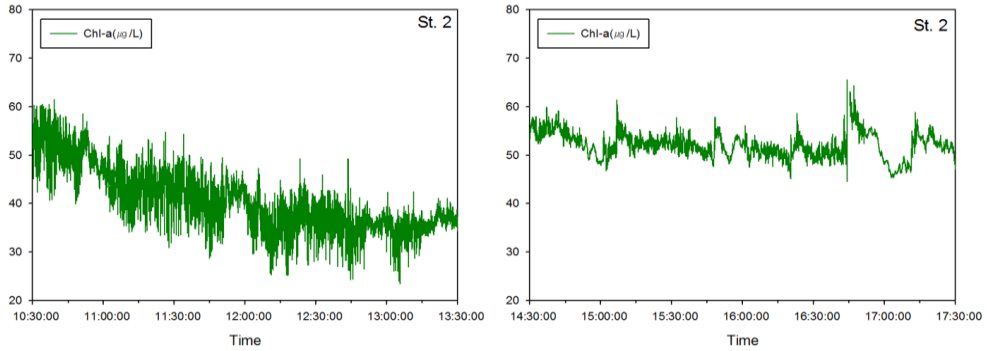

Fig. 3. Chl-a real-time data in the TiO_2 coated balls.

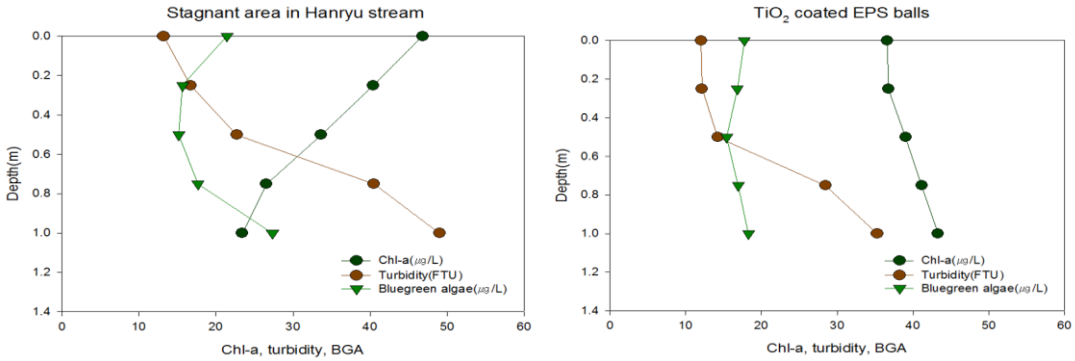

Fig. 4. Chl-a real-time data in the TiO_2 coated balls.

The vertical distribution results are as follows: Fig. 4. Chlorophyll-a concentration in stagnant area was high in water-surface and low in bottom. Where there is photocatalyst balls, chlorophyll-a concentration showed a lower values in water-surface than the bottom. The result may differ according to the weather (especially ultraviolet intensity) but we were able to identify stunted growth of algae from 0 to 0.2 m.If applied to a wide water surface area, algae growing in the stagnant stream is expected to be inhibited.

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