Improving the productivity of bean sprouts with slightly acidic electrolyzed water

Sprouts are among the most popular and favorite vegetables in Japan and other countries. They are easy to produce and contain many nutrients that benefit human health. During the germination of seeds and the growth of sprouts, watering at a regular time is needed; however, if the surrounding environment is humid and warm, it will provide a suitable condition for microbial reproduction. Once high microbial populations exist on the sprouts, it will have a negative impact on the shelf life of sprouts and ultimately on human health. Sprouts are often used as ready-to-eat vegetables, thus measures should be taken to control microbial contamination on the sprouts, and a successful seed decontamination treatment must be performed to inactivate microbial pathogens while preserving seed viability, germination, and vigor.

Slightly acidic electrolyzed water (SAEW), which has a near-neutral pH and contains available chlorine concentration (ACC), can be generated by electrolyzing dilute hydrochloric acid. SAEW has many advantages: 1) It is a kind of high-efficiency disinfection agent; 2) It is converted to normal water after use, so it is environmentally friendly; 3) It physically kills microorganisms, and prevents microorganisms from acquiring resistance; and 4) It functions at room temperature, so SAEW does not result in changes in ingredients, texture, scent, or flavor which often occur after heat treatment. In this study, SAEW was applied in producing bean sprouts and the effects of SAEW on germination, sprout growth, and physiological activity of bean seeds were evaluated.

Results demonstrated that SAEW with available chlorine concentration (ACC) of around 10 mg/L could greatly improve germination percentage (Fig. 1). Sprout length of soybean seeds soaked and then watered during germination period by SAEW was significantly longer than that of tap water (TW) control ($P<0.05$). Also, using SAEW instead of TW in either soaking or germination period could enhance sprout length (Fig. 2).

Results also indicated that soybean soaked in SAEW prior to germination greatly affected the later growth of sprouts. The length of soybean sprouts after five days of germination treated by TW or SAEW with different pH and ACC are shown in Figure 3. Furthermore, both pH and ACC of SAEW can affect the growth of soybean sprouts. Figure 4 shows the effect of SAEW on the length of mungbean sprouts. Mungbean sprouts treated with SAEW of ACC 10, 20 and 30 mg/L grew longer than TW control by 23.87, 25.81 and 23.04 %, respectively, after soaking procedure.

In Japan, SAEW has been an authorized food additive since 2002 and a specified agricultural chemical since 2014 because of its proven biological safety and effectiveness as a bactericide even at a low ACC of 10–30 mg/L and pH of 5.0–6.5. SAEW shows promise as a kind of disinfectant for seed sprouts, not only by reducing microorganism populations and prolonging shelf life but also by promoting sprout growth.

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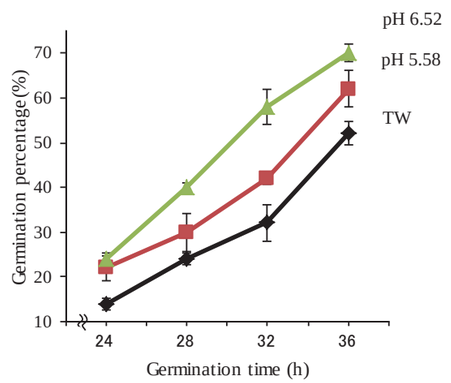

Fig. 1. Effect of slightly acidic electrolyzed water (ACC 10 mg/L) on the germination percentage of soybean seeds

TW: Tap water (pH 7.35 and ACC not detected)

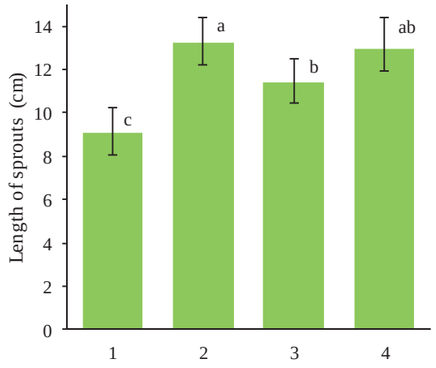

Fig. 2. The length of soybean sprouts treated by slightly acidic electrolyzed water (SAEW) after five days of germination

1-soaked and watered during germination by TW

2-soaked and watered by SAEW

3-soaked in SAEW and watered by TW

4-soaked in TW and watered by SAEW

Different letters mean statistically significant difference ($P<0.05$).

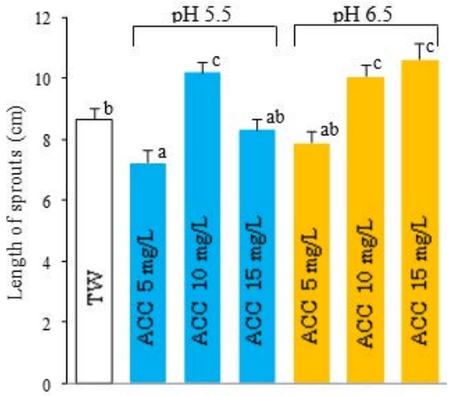

Fig. 3. The length of soybean sprouts treated by TW and SAEW after five days of germination

Different letters mean statistically significant difference ($P<0.05$).

Fig. 4. The effect of SAEW on mungbean sprouts after 108 hours of germination

The length of mungbean sprouts is written in parentheses.