

Role of Chloride Ions in Plasma-Activated Water Treatment Processes

Ghazaleh Haghighat, Amirreza Sohrabi*, Parmiss Mojir Shaibani, C. W. Van Neste, Selvaraj Naicker,

Thomas Thundat

Department of Chemical and Materials Engineering, University of Alberta, Edmonton, AB T6G 1H9,

Canada

*Corresponding Author- Email: sohrabi@ualberta.ca

Tel: +1-780-667-7914

Supplementary Information

- Measurement of hydrogen peroxide in the solution

Figure S1(a) H_2O_2 was added directly to the solution (MillQ water + 50 mg/l NaCl and 0.75 mg/l MB) and change in the concentration of MB was monitored as a function of time. Although H_2O_2 is known to be an oxidizing agent, it can induce minimal MB decontamination, only at high concentrations. Figure S1(a) shows that only 5% of MB can be removed when H_2O_2 with concentration of 120 mM is added to the solution directly. This concentration of H_2O_2 significantly exceeds the concentrations measured in our system, as shown in Figure S1(b). It is worth mentioning that The concentration of H_2O_2 was measured using previously published method based on the application of the fluorescence probe, Amplex Red [40,41]. Figure S1(b) shows that the produced H_2O_2 remains in the solution for a long time after plasma is extinguished. As discussed in this study, the presence of H_2O_2 is necessary for production of $\text{O}=\text{NOOH}$ (reaction (5)) and $^1\text{O}_2$ (reaction (10)). These compounds are responsible for removal of MB during the post treatment stage.

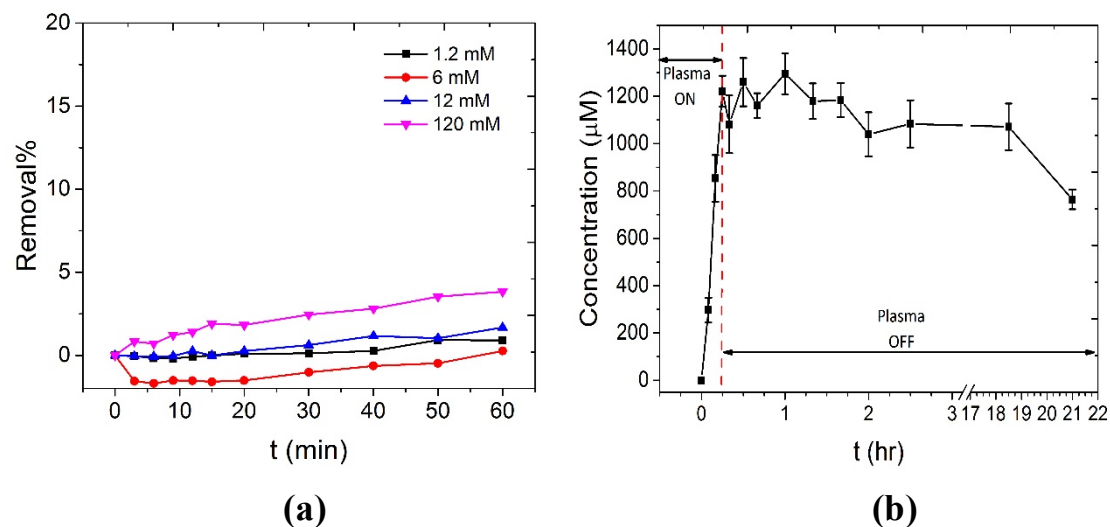


Figure S1. As a control experiment, various concentrations of H_2O_2 were added to the MB containing solutions. (a) shows the removal% of MB as a function of time. Only minute removal of MB can be achieved (about 5%) when high concentrations of H_2O_2 (120 mM) are added to the solution. These high concentrations of H_2O_2 significantly exceeds the concentrations measured in our experiments, as shown in (b). In our experiments, the concentration of H_2O_2 was evaluated by means of fluorescence probe, Amplex red, according to previously published methods. Moreover, (b) shows that H_2O_2 can stay in the solution for a long period of time in the post treatment stage. As a result, they can react with HOCl to produce 1O_2 in the solution and continue the removal of MB in this stage