

Abstract

The application of non-thermal plasma in agriculture has gained a high attention over the last decade and opened a new and promising field that combines plasma physicists/chemists and biologists, the new field is called **plasma agriculture**. This thesis entitled “new possibilities of the use of cold plasma in agriculture” is a contribution to this plasma agriculture field.

Cold plasma qualified as “clean” technology is a rich source of reactive oxygen and nitrogen species (RONS) formed in gas or in contact with water/liquid. Two DC cold plasma sources have been used in this thesis, namely the transient spark discharge with electrosprayed water and the glow discharge both operating in laboratory air conditions at atmospheric pressure in contact with water. The plasma sources were used to produce plasma activated water by activating tap water. The treated water resulting from the activation was analyzed by UV-Vis spectroscopy through the colorimetric methods to evaluate the concentration of the long-life species present in the activated water: hydrogen peroxide, nitrate and nitrites ions, which play a key role in the seed/plant development as nitrogen supplement and signalling agent.

Plasma activated water has been used in different ways. The first way was through the growth enhancement of the maize and barley seedlings up to four weeks, then by using it as a priming tool to improve the yield of pea seeds in the outdoor field, the third way by evaluating the action of the treated water on the physiological properties of the 3-days seedlings of pea and barley seeds, and finally by investigating the ageing effects of plasma activated water on the growth parameters of maize seedlings.

By examining the different results obtained with plasma activated water from both cold plasma sources we can conclude that the effects on plant growth and yield are promising. It was worth to take this topic and focus on the study of the effect of plasma activated water in agriculture.

In summary, the plasma activated water effect in agriculture which has not been well explored compared to the direct plasma seed treatment, has shown a wide potential and a bright future in the plasma agriculture field.

Keywords: Plasma activated water, transient spark discharge, glow discharge, seeds, seedlings, reactive oxygen, and nitrogen species, plasma agriculture.