

# PLASMA CLUSTER IONS (PCI) INFLUENCE ON MICROBIAL CELLS VIABILITY

Ilya E. Digel, Aysegül Temiz, Gerhard Artmann, **Nojima**

*University of Applied Sciences, Aachen, Germany*

The health implications of indoor microbial contaminants have become an issue of increasing concern in recent years. Most of the people spend much time indoors, which makes indoors an important microenvironment in terms of air pollution. Many air pollutants access the body via inhalation of indoor air because of both the percentage of lifetime spent indoors and higher indoor pollution levels. Some biological contaminants cause infections, trigger allergic reactions, including hypersensitivity pneumonitis, allergic rhinitis, and some types of asthma.

Recently, SHARP corporation has developed the world's first "Plasma Cluster Ions (PCI)" air purification technology, which uses plasma discharge to generate cluster ions. The new plasma cluster device releases into the air positive and negative ions, which are harmless to humans and are able to decompose and deactivate airborne substances by chemical reactions.

A lot of phenomenological tests of the PCI air purification technology on microbial cells have been conducted. And, in most cases, it has been shown that PCI demonstrate strongly pronounced killing effect. Although, the particular mechanisms of PCI action are still not evident.

We studied variations in resistance to PCI among gram-positive airborne microorganisms, as well as some dose-dependent, spatial, cultural and biochemical properties of PCI action in respect of *Staphylococcus spp*, *Enterococcus spp*, *Micrococcus spp*.

According to our time/dose-dependent experiments, the inhibiting effect becomes apparent in first minutes of PCI emission and leads to irreversible 99 % killing rate during the first 2-3 hours of treatment. Furthermore, particular changes in total protein composition have been studied using one-dimensional SDS PAGE and red-ox enzymes (catalase, superoxiddismutase) activity detection methods.

The influence of PCI was observed also in long-term cultivation in liquid medium where cell population growth rate and kinetics of substrate consumption were used as indicative parameters. A chemical nature of PCI core as well as PCI interaction with individual cell components have been investigated using specific free-radical detection systems.

These and other data allow us to suggest several possible chemical and biological mechanisms, particular targets of PCI in cell and possible cases of relative resistance.