PLASMA HEALTH CARE – AIMS, CONSTRAINTS, AND PROGRESS

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Health Care covers three areas of interest for cold atmospheric pressure plasmas: Cosmetics, Hygiene and Medicine. These areas can be subdivided into personal and professional care. In this review will concentrate on Hygiene and Medicine. In professional hygiene the most important plasma contribution is sterilization, decontamination and disinfection. The main aim is the prevention of diseases or their containment. Progress in the development of efficient bactericidal plasma sources has been rapid, so that it appears realistic to use plasmas to combat nosocomial infections as well as community associated infections in the not too distant future. The advantages of plasma devices – they use air and electricity only, there are no waste products, they are inexpensive to manufacture and operate, easy to transport and install, and bactericidal effects are fast (seconds). Plasmas can efficiently kill resistant bacteria (e.g. MRSA) and tests have shown no resistance build-up so far. With an estimated 2 Million hospital induced infections each year in the US alone, and about 100.000 resulting deaths, very efficient, safe and fast hospital plasma hygiene devices would appear to be a very important weapon to help contain the spread of infectious diseases. Similarly, containment in public places and services could be improved significantly using plasma hygiene devices. Last but not least comes food hygiene where the aim is to disinfect food for longer storage without harming tissue. At the personal level, plasma disinfection can play a role in household appliances, for the prevention and treatment of fungal diseases, for parodontosis and tetanus prophylaxy, to name but a few applications currently under discussion. There are first indications that plasmas can alleviate a number of skin irritations, too. In Medicine there are a number of ambitious ideas and aims. Plasmas can be "designed" to some extent. They can include different active species that can have an effect at the cellular level. There are ionic atoms and molecules, whose medical use need to be evaluated – the vision is that a new area of "plasma pharmacy" could develop. First steps are currently being taken in biological studies. Also the excited atoms in cold atmospheric plasmas may make cell walls more permeable for such species. This could be employed for distinguishing between different types of cells (e.g. cancer cells) and thus applying specific treatments at the cellular level. Of course, a word of caution is in order. Some issues seem straightforward and they will presumably lead the initial applications. Careful studies will be essential to understand the action of different plasmas on human cells, prokaryotic cells, viruses, spores, fungi to reap the benefits and avoid possible pitfalls. Other issues – like the plasma pharmacy – may be too complicated to achieve in the next two or three decades. But this is a grand challenge – chemical/biological pharmacy is an old subject and is nevertheless an area where major research is still essential.