Device for generating a cold atmospheric pressure plasma

The invention relates to a device for generating a cold atmospheric pressure plasma for the treatment of human and / or animal surfaces according to claim 1 and a generator unit for providing a high-voltage according to claim 10.

In plasma medicine, promising applications in the treatment of living tissue have been developed in the last few years, from the collaboration of classical plasma-physics and life sciences. The focus of the plasma applications was on the use of non-thermal atmospheric pressure plasmas for decontamination up to the sterilization of living tissue, i.e. the killing of pathogens on or in a living tissue. However, the plasma treatment is not limited to disinfection and sterilization. Other applications which exploit the particular properties of the plasma can also have beneficial effects for the medicine.

A possible use of plasma is the promotion of healing of wounds, such as chronic and / or postoperative wounds, but also the treatment of burns, abrasions, eye and mucous membrane infections, etc. In addition, also the use for disinfection, wrinkle treatment and / or other cosmetic treatments can be envisioned. In particular chronic wounds, such as diabetes-induced wounds, cause a great suffering in the affected patients and are often associated with high stress for the patient. Conventional therapy approaches in many cases do not lead to the desired healing of the wounds, so that often only the status quo is maintained.

A promising approach to therapy of chronic wounds is the use of cold plasmas, so-called atmospheric pressure plasmas. Plasma is considered a fourth state of matter and consists of ionized gas with physical peculiarities. Plasma is electrically charged gas and conducts electrical current. In addition, it contains a variety of radicals, such as free electrons, ions, and / or other excited species. Furthermore, plasma emits UV and visible light as well as other electromagnetic fields.

By the development of body-compatible plasmas with temperatures of less than 40 °C a new, highly actual research field emerged - the plasma medicine. These "cold plasmas" are the basis of many different applications in plasma medicine. Known, available plasma sources have demonstrated their ability in the context of the therapy of various skin diseases and / or the treatment of chronic wounds in clinical trials. A substantial disadvantage of the known plasma sources, however, is that until now only small wound areas can be treated since the known plasma sources are relatively small.

Moreover, known plasma sources are difficult to control, i.e., difficult to dose and handle.

There is therefore a need for an improved, large-area plasma source for atmospheric pressure plasmas, particularly for the treatment of human and / or animal surfaces.

The object of the present invention is to provide a device for producing a cold atmospheric pressure plasma for the treatment of human and / or animal surfaces, wherein a large-area, in particular approximately 400 cm^2, plasma source is to be provided. In addition, the plasma source is to adapt flexibly to the topography of the surfaces to be treated, particularly to the different sizes and shapes of the application area and the application. It is also an object of the invention to provide a cable, a generator and a system for operating a (plasma) device for producing a large-area, cold atmospheric pressure plasma for the treatment of human and / or animal surfaces.

The above object is achieved according to the invention by an apparatus for producing a cold atmospheric pressure plasma for the treatment of human and / or animal surfaces according to claim 1 and a generator unit for providing a high-voltage as claimed in claim 10. Subject matter according to the dependent subclaims describe preferred embodiments of the invention.

A first aspect of the invention relates to a device, in particular a plasma device, for producing a cold atmospheric pressure plasma for the treatment of human and / or animal surfaces, comprising a flexible, planar multilayer system with a side facing the surface to be treated and a side facing away from the surface to be treated, wherein the multilayer system comprises the following layers, namely a first electrode layer on the facing away side of the multilayer system, a second electrode layer on the facing side of the multilayer system, wherein the electrode layer has a plurality of recesses or is formed as a grid or meandering, a dielectric layer which is arranged between the first electrode layer and the second electrode layer, and at least one spacer or a spacer layer adjacent to the second electrode layer on the facing side of the multilayer system.

In the following, the concept of the invention is described by way of example without limiting the invention. The device according to the invention, in particular the plasma device, essentially serves for the treatment of human and / or animal surfaces, in particular the treatment of wounds, such as, for example, chronic and / or