Claims

1. An illumination system for photodynamic therapy, the illumination system comprising an illumination source, which is configured to emit an electromagnetic radiation to illuminate a target surface during operation, and an electronic control unit,

wherein the illumination source is configured such that the intensity of the electromagnetic radiation emitted by the illumination source can be varied,

wherein the electronic control unit is operatively connected to the illumination source and configured to control operation of the illumination source according to an illumination protocol during an illumination session performed with the illumination system, and

wherein the illumination protocol comprises instructions to operate the illumination source during the illumination session in a plurality of different modes, the modes comprising:

a) a first mode, wherein, in the first mode, the electronic control unit controls operation of the illumination source such that the intensity of the electromagnetic radiation emitted by the illumination source is increased continuously or quasi-continuously from a base intensity B to a target intensity T within a first mode time interval, wherein the first mode time interval is greater than or equal to 1 min,

b) a second mode, wherein, in the second mode, the electronic control unit controls operation of the illumination source such that the intensity of the electromagnetic radiation emitted by the illumination source is constant or substantially constant for a second mode time interval, and

c) a third mode, wherein, in the third mode, the electronic control unit controls operation of the illumination source such that

the illumination source is operated such that darker phases and illumination phases alternate for a third mode time interval,

wherein the intensity of the electromagnetic radiation emitted by the illumination source is lower in the darker phases than in the illumination phases, or

wherein, in the darker phases the illumination source does not emit electromagnetic radiation whereas the illumination source emits electromagnetic radiation in the illumination phases,

wherein the target surface is a skin of a patient,

wherein the target surface is arranged at a target location relative to the illumination source during the illumination session,

wherein a distance between a radiation exit surface of the illumination source and the target location is between 5 cm and 15 cm.

2. The illumination system of claim 1, wherein the illumination system comprises machine-readable instructions loaded in the electronic control unit to cause the illumination source to operate according to the illumination protocol.

3. The illumination system of claim 1 or 2, wherein the durations of the darker phases are constant and different from the duration of the illumination phases.

4. The illumination system of any one of the preceding claims, wherein B is

- less than or equal to one of the following values: 0.5T, 0.45T, 0.4T, 0.35T, 0.3T; and/or
- greater than or equal to one of the following values: 0.1T, 0.15T, 0.2T, 0.25T, 0.3T.

5. The illumination system of any one of the preceding claims, wherein the illumination source is operated in the second mode after the first mode and/or before the third mode during the illumination session.

6. The illumination system of any one of the preceding claims, wherein the beginning of the operation of the illumination source in the first mode defines the start of the illumination session and the end of the operation of the illumination source in the third mode defines the end of the illumination session.

7. The illumination system of any one of the preceding claims, wherein every mode selected from the first mode, the second mode, and the third mode of operation of the illumination source occurs once, preferably only once, during the illumination session.

8. The illumination system of any one of the preceding claims, wherein the electromagnetic radiation has a peak wavelength in the visible spectral range, e.g. in the red, green, yellow, or blue spectral range.

9. The illumination system of any one of the preceding claims, wherein the target surface is arranged at a target location relative to the illumination source during the illumination session, and wherein the illumination system is configured to irradiate the target surface with a predetermined radiation dose during the illumination session.

10. The illumination system of claim 9, wherein the radiation dose is

- greater than or equal to one of the following values when the target surface is arranged at the target location relative to the illumination source during the illumination session: 30 J/cm2, 35 J/cm2, 37 J/cm2; and/or

- less than or equal to one of the following values when the target surface is arranged at the target location relative to the illumination source during the illumination session: 45 J/cm2, 40 J/cm2, 37 J/cm2.

11. The illumination system of claim 9, wherein the radiation dose is

- greater than or equal to one of the following values when the target surface is arranged at the target location relative to the illumination source during the illumination session: 8 J/cm2, 9 J/cm2, 10 J/cm2; and/or

- less than or equal to one of the following values when the target surface is arranged at the target location relative to the illumination source during the illumination session: 12 J/cm2, 11 J/cm2, 10 J/cm2.

12. The illumination system of any one of the preceding claims, wherein the distance between the radiation exit surface of the illumination source and the target location is between 5 cm and 8 cm.

13. The illumination system of any one of the preceding claims, wherein the duration of the entire illumination session is less than or equal to one of the following values: 20 min, 19 min, 18 min, 17 min, 16 min, 15 min, 14 min, 13 min.

14. The illumination system of any one of the preceding claims, wherein the second mode time interval, and/or the third mode time interval is greater than or equal to one of the following values: 1 min, 1.5 min, 2 min, 2.5 min, 3 min, 3.5 min, 4 min, 4.5 min, 5 min.

15. The illumination system of any one of the preceding claims, wherein the duration of one darker phase and/or of one illumination phase is greater than or equal to one of the following values: 15 s, 20 s, 25 s, 30 s.

16. A method for operating an illumination source, wherein the illumination source is operated according to an illumination protocol during an illumination session performed with the illumination system, and wherein the illumination protocol comprises instructions to operate the illumination source during the illumination session in a plurality of different modes, the modes comprising:

a) a first mode, wherein, in the first mode, the illumination source is operated such that the intensity of the electromagnetic radiation emitted by the illumination source is increased continuously or quasi-continuously from a base intensity B to a target intensity T within a first mode time interval, wherein the first mode time interval is greater than or equal to 1 min, and wherein a priming mode of 10 s to 4 min precedes the first mode, wherein, in the priming mode, the intensity P of the electromagnetic radiation emitted by the illumination source is less than or equal to the base intensity B,

b) a second mode, wherein, in the second mode, the illumination source is operated such that the intensity of the electromagnetic radiation emitted by the illumination source is constant or substantially constant for a second mode time interval, and

c) a third mode, wherein, in the third mode, the illumination source is operated such that darker phases and illumination phases alternate for a third mode time interval, wherein

the intensity of the electromagnetic radiation emitted by the illumination source is lower in the darker phases than in the illumination phases, or wherein,

in the darker phases the illumination source does not emit electromagnetic radiation whereas the illumination source emits electromagnetic radiation in the illumination phases.

17. A computer program product, such as a data carrier, e.g. a non-transitory data carrier, or data stream, the computer program product containing machine readable instructions which, in particular when loaded in and/or executed by a computer system, e.g. by an electronic control unit thereof, cause an illumination source to be operated according to the method of claim 16.

18. A kit for treating a disease, in particular a skin disease, comprising:

a pharmaceutical substance suitable to be topically applied to the skin in a region to be treated, and

an illumination system as claimed in any one of claims 1 to 15, wherein the illumination system is configured to irradiate a region of the skin to which the substance has been applied.

19. Use of a pharmaceutical substance in the manufacture of a medicament for treating a skin disease, wherein the pharmaceutical substance is to be topically applied to the skin in a region to be treated, and the region is to be irradiated with an illumination source according to the method of claim 16 and/or using an illumination system as defined in any one of claims 1 to 15.

20. The illumination system of any one of claims 1-15 for use in a method for treating a skin disease, wherein the method comprises the following steps:

a) applying a pharmaceutical substance to the surface of the skin in a region which is to be treated;

b) irradiating the region with the illumination system of any one of claims 1 to 15.

21. The use of claim 19, the illumination system for use of claim 20 or the kit of claim 18, wherein the pharmaceutical substance is a photosensitizing drug or precursor to such a drug that is excitable by radiation in the emitted spectrum.

22. The use of claim 19, the illumination system for use of claim 20 or the kit of claim 18, wherein the skin disease is a neoplastic skin disease like actinic keratosis, basal cell carcinoma, squamous cell carcinoma in situ, or warts, acne, wound healing disorders/chronic wounds, bacterial and/or fungal infections, inflammatory skin diseases.