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(54) Benævnelse: **Fremgangsmåde og apparatur til bearbejdning af slagtet fjerkræ**

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DESCRIPTION

[0001] The invention relates to a method of processing slaughtered poultry that is conveyed in a slaughter line of a slaughter house, in order to establish at the start of said slaughter line whether the poultry was alive or dead on arrival at the slaughter house, comprising the detection of a body parameter of the slaughtered poultry when said poultry is suspended by the legs in the slaughter line after stunning of said poultry.

[0002] The invention further relates to an apparatus for processing slaughtered poultry according to such a method, comprising a slaughter line and detection means that are arranged to detect a body parameter of the slaughtered poultry when said poultry is suspended by the legs in the slaughter line after it being stunned.

[0003] Such an apparatus and method are known from EP-B-0 819 381.

[0004] In the known apparatus and method the poultry that is transported to the slaughter house is first stunned, then suspended by the legs, and conveyed further down the line for ex-sanguination, de-feathering, decapitating, visual inspection of the outside, weight determination, evisceration and veterinary inspection of the poultry carcass and viscera before it gets cooled, portioned, and refrigerated. The determination of whether or not poultry has arrived at the slaughter house dead or alive is mentioned in EP-B-0 819 381 as an example in a process which is predominantly concerned with providing a completely, or almost completely automatic performance of inspection tasks. When used for determining whether the poultry was dead or alive on arrival, EP-B-0 819 381 teaches to use temperature measurements for that purpose.

[0005] EP 2 534 953 teaches an improved method and system for determining whether the poultry was dead or alive on arrival at the slaughterhouse, also making use of temperature measurements but then at very specific locations.

[0006] Current legislation on the processing of slaughtered poultry requires that only healthy, alive poultry may be hung in the slaughter line. As is mentioned in the preamble the poultry is suspended by the legs after first being stunned. This makes it difficult to determine whether the poultry was DOA (dead on arrival) or merely stunned, since in both cases the poultry doesn't move. The problem is even more prone in situations that the poultry died shortly before arriving at the slaughterhouse since then rigor mortis has not yet occurred, and the personnel which hangs the birds cannot identify the difference between a stunned bird or a genuine DOA bird.

[0007] It is an object of the invention to further improve the accuracy and reliability of the apparatus and method according to the preamble, to determine whether the poultry arriving at the slaughter line was dead or alive.

[0008] A further object of the invention is to prevent as much as possible the occurrence of false positives, that is to say the determination of poultry being alive on arrival which are deemed to have arrived at the slaughterhouse dead.

[0009] Generally speaking it is therefore an object of the invention to assess the immediate history and status of the suspended poultry.

[0010] Still a further object of the invention is to better monitor the process of killing the poultry in the initial phases of its processing in the processing line. The intention here is to improve animal welfare in the poultry's final life stages.

[0011] The invention is embodied in a method and apparatus according to any one of the appended claims.

[0012] In a first aspect of the invention an absorption spectrum of blood of the slaughtered poultry is determined and based thereon it is decided whether the poultry was alive or dead on arrival at the slaughter house. Accordingly the apparatus of the invention comprising a slaughter line has means to establish at the start of said slaughter line whether the poultry was alive or dead on arrival at the slaughter line, wherein said means are embodied as detection means that are arranged to determine an absorption spectrum of blood of the slaughtered poultry while the poultry is suspended by the legs.

[0013] According to the invention it is preferred that the apparatus and method of the invention are arranged to use the absorption spectrum for determining a level of deoxygenation of the blood of the poultry. This is found to be a reliable measure to distinguish between genuine DOA birds and birds that have been stunned.

[0014] To promote the accuracy of the method and apparatus of the invention it is preferred that the absorption spectrum is determined for wavelengths between 200 nm and 1000 nm.

[0015] Better results are even attainable when the absorption spectrum is determined for wavelengths between 600 nm and 800, and optimal results are achieved when the absorption spectrum is determined for wavelengths around approximately 680 nm.

[0016] To provide reliable results it is also preferred that stunning of the poultry is executed by controlled atmosphere stunning wherein an atmosphere with depleted oxygen is applied. Such an atmosphere with depleted oxygen is notably provided with excess amounts of carbon dioxide, Argon or N2. As a result of this method of stunning the blood is extremely deoxygenated, which makes it easier to distinguish between those stunned birds and DOA birds

[0017] In one embodiment an absorption spectrum of blood of the slaughtered poultry is determined of the blood in the arteries and/or in the veins. It is then possible to either determine said absorption spectrum in the arteries or in the veins, or in both the arteries and

the veins. This last option may even result in an even more reliable determination of birds being DOA or stunned by looking at a possible difference in said absorption spectra of both the blood in the arteries and of the blood in the veins.

[0018] One possible way of making possible to look at the absorption spectra of the blood is initiated in that prior to determining the said absorption spectra at least one of the arteries and/or the veins of the poultry is cut.

[0019] In a preferred embodiment of the method and apparatus of the invention the absorption spectrum of the blood of the slaughtered poultry is however determined noninvasively. This obviates the need that the poultry will be required to actually bleed when it is cut, since cutting is completely avoided in the process of determining DOA birds. This is a big advantage since bleeding of DOA birds is generally impaired depending on the duration of their death. Furthermore it avoids the mess of the blood spilling in the slaughterhouse when the determination of the absorption spectrum of the blood is done noninvasively. To make the measurement noninvasively is particularly advantageous since in modern processing lines the rate of operation is 18,000 birds per hour, and the corresponding swinging of the birds makes cutting a real challenge, not to mention the problems associated with the difference in bleeding rate that different birds may exhibit.

[0020] A preferred position at which the absorption spectrum of said blood of the slaughtered poultry is determined is at non-feathered skin or skin parts of the poultry. The sensitivity of the measurement as well as its reliability is of a high standard at these locations. Best results are achieved when the absorption spectrum of said blood of the slaughtered poultry is determined at one of the wattles of the poultry. More preferable even the absorption spectrum of said blood of the slaughtered poultry is determined at both wattles of the poultry. Not only are the wattles highly perfused with blood, which supports a reliable assessment of the birds being dead on arrival or not. Further as a result of a decreasing contrast between the wattles and the surrounding skin tissue depending on the longevity of the birds being dead, it is also possible to derive information on the conditions prevailing during transport of the poultry to the slaughterhouse. This information can be used to improve animal welfare and to promote a humane slaughtering process.

[0021] The invention will hereinafter be further elucidated with reference to the drawing.

[0022] In the drawing:

- figure 1 shows an exemplary embodiment of the apparatus according to the invention;
- figure 2 shows a live chicken; and
- figure 3 shows measurement signals derived with the method and apparatus of the invention.

[0023] Figure 1 shows schematically a processing line for poultry embodied as a suspension

conveyor 5 moving in the direction of arrow A, in which conveyor 5 poultry 1, 2, 3, 4 is suspended by the legs.

[0024] Figure 2 shows a picture of a live chicken, which is particularly provided to assist the skilled person to understand the anatomy of poultry, in particular with regard to the location of the wattles near to the poultry's head. The wattles that will be referred to hereinafter, are indicated with arrow A.

[0025] Turning again to figure 1 the processing line 5 is at the start of said slaughter line provided with means 9, 10, 11 to establish whether the poultry 1, 2, 3, 4 was alive or dead on arrival at the slaughter line. These means are for that purpose embodied as detection means 9, 10, 11 that are arranged to determine an absorption spectrum of the blood of the slaughtered poultry 1, 2, 3, 4. In figure 1 the detection means 9, 10, 11 are provided at several altitudes to take account of poultry with different dimensions. It is however also possible that a single detection means is applied which is tunable in height. In figure 1 it is shown that the detection means 10 are specifically arranged to determine the absorption spectrum of the blood of the slaughtered poultry at one of the wattles of the poultry. Preferably however the detection means 10 are arranged to determine the absorption spectrum of said blood of the slaughtered poultry at both wattles of the poultry. The location of the wattles is shown in figure 2 as explained above.

[0026] Other possibilities to determine the absorption spectrum of the blood of the poultry are also feasible, such as the option that the detection means 9, 10, 11 are arranged to determine an absorption spectrum of the blood in the arteries and/or in the veins of the poultry. In a specific case it then can be opportune that the detection means 9, 10, 11 are arranged to determine a difference in said absorption spectrum with reference to the blood in the arteries and with reference to the blood in the veins. The blood can be made available for the absorption measurement by cutting the arteries and/or the veins of the poultry. Most preferred however is that the detection means 9, 10, 11 -as is shown in figure 1- are arranged to determine the absorption spectrum of said blood of the slaughtered poultry noninvasively. In one embodiment the detection means 9 are arranged to determine the absorption spectrum of said blood of the slaughtered poultry at non-feathered skin or skin parts of the poultry. The earlier mentioned location for determining the absorption spectrum of the blood at the wattle or wattles of the poultry with detection means 10 is the most preferred option.

[0027] Figure 1 further shows that the detection means 9, 10, 11 connect to calculating means 12 in order to determine a level of deoxygenation of the blood based on the absorption spectrum. The outcome of the calculating means 12 is then used in a control device 13 to establish whether or not the measured poultry 1, 2, 3, 4 was dead or alive on arrival at the slaughter house. Based thereon the control device 13 may provide an output signal via a line 14 that is used as an actuating signal for a separating device (not shown but known for the person skilled in the art) that is used to release the bird that has been established as being dead on arrival from the conveyor line 5.

[0028] In figure 3 a graph is provided representing measurement results at different wavelengths varying between 200 nm and 1000 nanometer, wherein a first graph shows the results with oxygenated blood HbO_2, and wherein a second graph shows the results with deoxygenated blood Hb. With reference to these graphs it is according to the invention preferred that the detection means 9, 10, 11 are arranged to determine the absorption spectrum for wavelengths between 200 nm and 1000 nm. Preferred further options are that the detection means 9, 10, 11 are arranged to determine the absorption spectrum for wavelengths between 600 nm and 800 nm. Most preferred is that the detection means 9, 10, 11 are arranged to determine the absorption spectrum for wavelengths around approximately 680 nm.

[0029] Although the invention has been discussed in the foregoing with reference to an exemplary embodiment of the apparatus and method of the invention, the invention is not restricted to this particular embodiment which can be varied in many ways without departing from the invention. The discussed exemplary embodiment shall therefore not be used to construe the appended claims strictly in accordance therewith. On the contrary the embodiment is merely intended to explain the wording of the appended claims without intent to limit the claims to this exemplary embodiment. The scope of protection of the invention shall therefore be construed in accordance with the appended claims only, wherein a possible ambiguity in the wording of the claims shall be resolved using this exemplary embodiment.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP0819381B **[0003]** **[0004]** **[0004]**
- EP2534953A **[0005]**

PATENTKRAV

1. Fremgangsmåde til bearbejdning af slagtet fjerkræ (1, 2, 3, 4), som fremføres i en slagtelinje (5) i et slagteri, med henblik på at etablere, ved starten af slagtelinjen, om fjerkræet (1, 2, 3, 4) var levende eller dødt ved ankomst til slagteriet, omfattende detektion af en kropsparameter for det slagtede fjerkræ, når fjerkræet er ophængt i benene i slagtelinjen (5) efter bedøvelse af fjerkræet, **kendetegnet ved, at** et absorptionsspektrum for blod i det slagtede fjerkræ (1, 2, 3, 4) bestemmes.

2. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge krav 1, **kendetegnet ved, at** absorptionsspektret for blod i det slagtede fjerkræ bestemmes for blod i arterierne og/eller i venerne.

3. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge krav 1 eller 2, **kendetegnet ved, at** en forskel i absorptionsspektret for blod i det slagtede fjerkræ bestemmes med reference til blodet i arterierne og med reference til blodet i venerne.

4. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge ethvert af kravene 1-3, **kendetegnet ved, at** før bestemmelse af absorptionsspektret opskæres i det mindste en af arterierne og/eller venerne i fjerkræet.

5. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge ethvert af kravene 1-3, **kendetegnet ved, at** absorptionsspektret for blodet i det slagtede fjerkræ bestemmes ved en ikke-fjerbelagt hud eller huddel af fjerkræet.

6. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge krav 5, **kendetegnet ved, at** absorptionsspektret for blodet i det slagtede fjerkræ bestemmes ved i det mindste en af hagelapperne på fjerkræet og fortrinsvis ved begge hagelapper på fjerkræet.

7. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge ethvert af de foregående krav 1-6, **kendetegnet ved, at** absorptionsspektret anvendes til at bestemme et niveau for deoxygenering af blodet.

8. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge ethvert af de foregående krav 1-7, **kendetegnet ved, at** bedøvelsen af fjerkræet foretages ved styret atmosfære-bedøvelse, hvor en atmosfære med reduceret oxygenindhold anvendes.

9. Fremgangsmåde til bearbejdning af slagtet fjerkræ ifølge ethvert af de foregående krav 6-7, **kendetegnet ved, at** en kontrast imellem hagelapperne og det omgivende hudvæv etableres og anvendes til at bestemme tilstandene foreliggende under transport af fjerkræet til slagteriet.

10. Apparatur til bearbejdning af slagtet fjerkræ, omfattende en slagtelinje (5) og organer (9, 10, 11) til at detektere, ved starten af slagtelinjen, om fjerkræet (1, 2, 3, 4) var levende eller dødt ved ankomst til slagtelinjen, hvilke organer er udformede som detektionsorganer (9, 10, 11), som er indrettede til at bestemme en kropsparameter for det slagtede fjerkræ, når fjerkræet er ophængt i benene i slagtelinjen (5), **kendetegnet ved, at** detektionsorganerne (9, 10, 11) er indrettede til at bestemme et absorptionsspektrum for blod i det slagtede fjerkræ (1, 2, 3, 4).

11. Apparatur til bearbejdning af slagtet fjerkræ ifølge krav 10, **kendetegnet ved, at** detektionsorganerne (9, 10, 11) er indrettede til at bestemme absorptionsspektret for blod i det slagtede fjerkræ i arterierne og/eller i venerne.

12. Apparatur til bearbejdning af slagtet fjerkræ ifølge krav 10 eller 11, **kendetegnet ved, at** detektionsorganerne (9, 10, 11) er indrettede til at bestemme en forskel i absorptionsspektret for blod i det slagtede fjerkræ med reference til blodet i arterierne og med reference til blodet i venerne.

13. Apparatur til bearbejdning af slagtet fjerkræ ifølge ethvert af kravene 10-12, **kendetegnet ved, at** detektionsorganerne (9, 10, 11) er indrettede til at bestemme absorptionsspektret for blodet i det slagtede fjerkræ på ikke-fjerbelagt hud eller huddele på fjerkræet.

14. Apparatur til bearbejdning af slagtet fjerkræ ifølge krav 13, **kendetegnet ved, at** detektionsorganerne (9, 10, 11) er indrettede til at bestemme absorptionsspektret for blodet i det slagtede fjerkræ ved i det mindste en af hagelapperne på fjerkræet, og fortrinsvis ved begge hagelapper på fjerkræet.

15. Apparatur til bearbejdning af slagtet fjerkræ ifølge ethvert af de foregående krav 10-14, **kendetegnet ved, at** detektionsorganerne (9, 10, 11) er forbundet med

beregningsorganer (12) med henblik på at bestemme et niveau for deoxygenering af blodet baseret på absorptionsspektret.

DRAWINGS

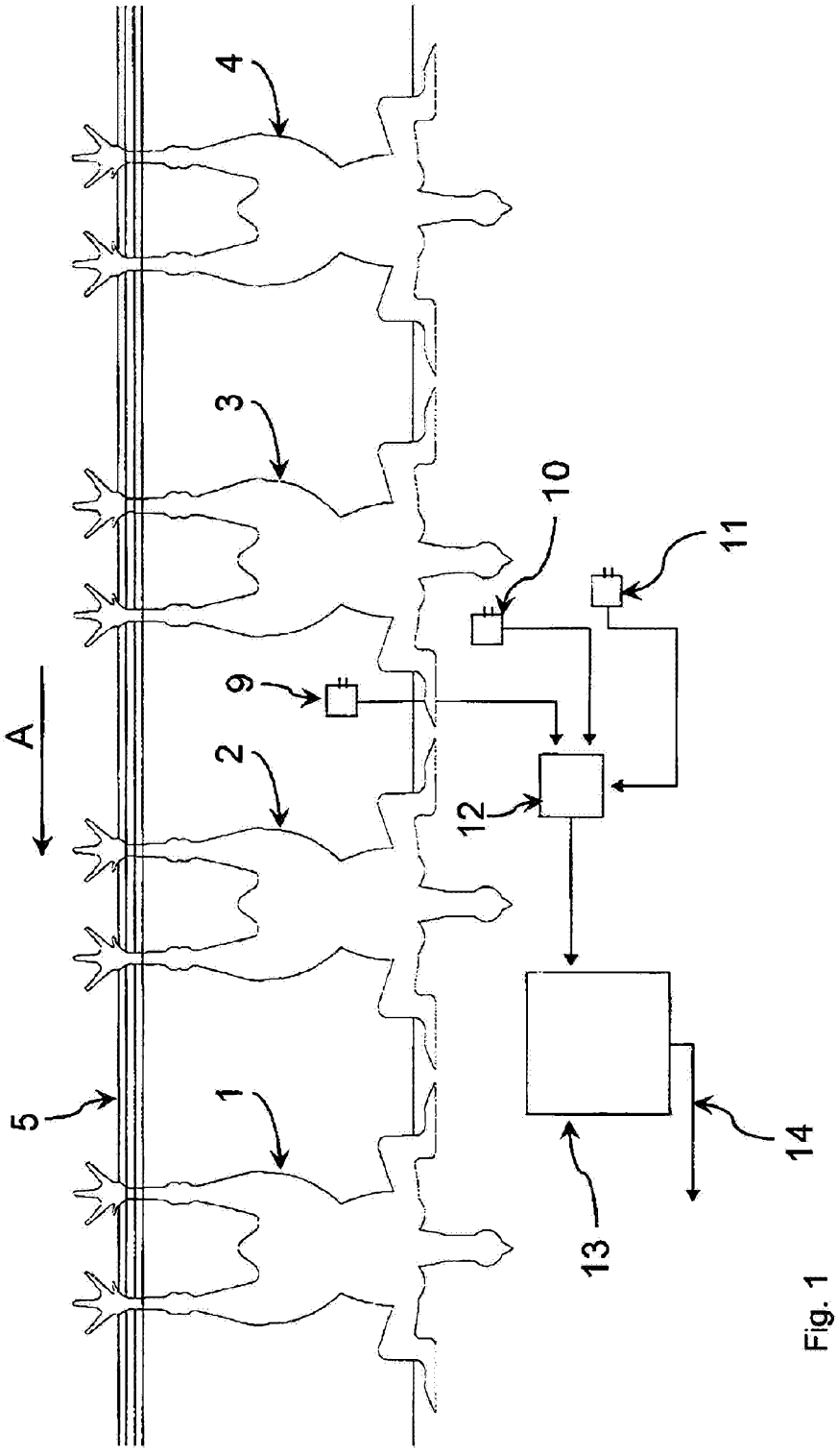

Fig. 1

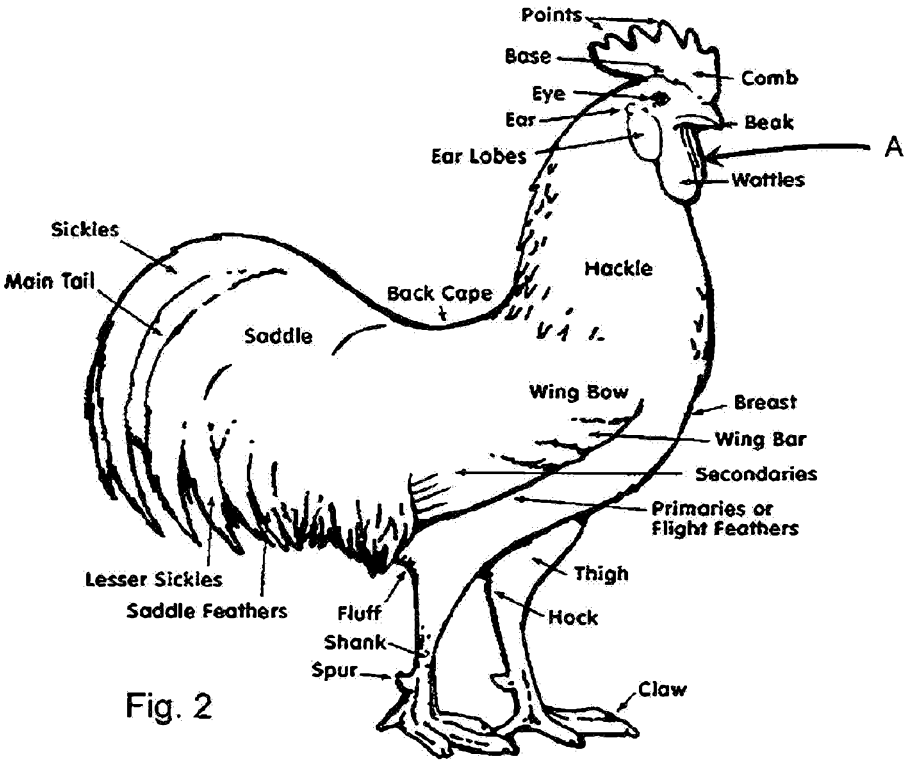
Points
Base
Comb
Eye
Ear
Beak
A
Ear Lobes
Wattles
Sickles
Main Tail
Hackle
Back Cape
Saddle
Wing Bow
Breast
Wing Bar
Secondaries
Primaries or
Flight Feathers
Thigh
Lesser Sickles
Saddle Feathers
Fluff
Hock
Shank
Spur
Claw

Fig. 2

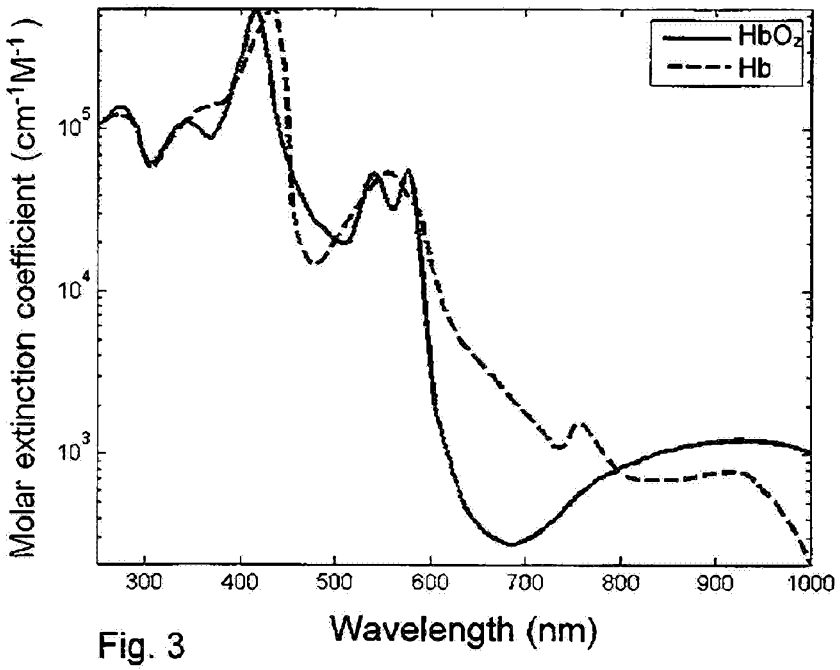
HbO2
Hb
Molar extinction coefficient (cm-1M-1)
10^5
10^4
10^3
300
400
500
600
700
800
900
1000
Wavelength (nm)

Fig. 3