There is provided a method of handling tobacco material. The method comprises the steps of heating the tobacco material such that the tobacco material is pasteurised; packaging the pasteurised tobacco material into packaging material; and sealing the packaging material. The step of heating is performed before the steps of packaging and sealing, and the steps of packaging and sealing are performed within a clean environment.

**Abstract:**

There is provided a method of handling tobacco material. The method comprises the steps of heating the tobacco material such that the tobacco material is pasteurised; packaging the pasteurised tobacco material into packaging material; and sealing the packaging material. The step of heating is performed before the steps of packaging and sealing, and the steps of packaging and sealing are performed within a clean environment.
PASTEURISATION OF TOBACCO

The present invention relates to a method and apparatus for the handling of tobacco material, particularly for the pasteurisation and packaging of tobacco material. Furthermore, the present invention relates to a packaged tobacco product comprising pasteurised tobacco material. The invention finds particular application in the packaging of fine-cut tobacco material.

Tobacco products for the self assembly of smoking articles typically have a relatively high moisture content compared to the tobacco material used in pre-manufactured smoking articles such as cigarettes. For example, roll-your-own tobacco products typically have a moisture content of about 15 to 18 percent by weight and make-your-own tobacco products typically have a moisture content of about 18 to 21 percent by weight. In comparison the moisture content of the tobacco material in pre-manufactured cigarettes is typically about 14 percent by weight or less.

As tobacco is an organic material, it may be subject to deterioration by microorganisms, such as mould. In moderate climates, mould spores are naturally present everywhere and the mould growth is favoured by moisture. The deterioration of tobacco may therefore be of particular concern for tobacco products having a high moisture content. One way to reduce or prevent mould growth is through the use of preservatives. However, the use of preservatives in tobacco products may not be desirable.

It is has previously been proposed to pasteurise snuff, a moist tobacco product, by bulk heating the snuff in a cooker to elevated temperatures over a certain period of time. The pasteurised snuff is then removed from the cooker and further processed. For example, US patent publication US-A-2008/0156338 discloses a process for the pasteurisation of snuff wherein the pasteurisation is carried out after the snuff has been packaged in a sealed container.

It has also been previously proposed to pasteurise fine-cut tobacco material for the self assembly of smoking articles, wherein the fine-cut tobacco is pasteurised within a sealed package which is preferably the retail package. However, in some cases, the package itself may be adversely affected by the environmental conditions of the pasteurisation.

It would be desirable to provide an improved method for the pasteurisation of tobacco material and an improved way of packaging the pasteurised tobacco. It would be particularly desirable to provide an improved way of packaging pasteurised fine-cut tobacco material for the self assembly of smoking articles.

According to the invention there is provided a method of handling tobacco material, the method comprising the steps of: heating the tobacco material such that the tobacco material is pasteurised; packaging the pasteurised tobacco material into packaging material; and sealing
the packaging material, wherein the step of heating is performed before the steps of packaging and sealing, and the steps of packaging and sealing are performed within a clean environment.

The term "clean environment" is used throughout this specification to mean an environment that has a low level of environmental pollutants such as dust, airborne microbes, aerosol particles and chemical vapours, like for example a clean room. In addition, the clean environment may use clean machinery and procedures, wherein the expression "use clean machinery and procedures" is construed as referring to the implementation of practices relating to equipment, personnel and materials with the aim of preventing contamination of the clean environment. These practices may include, for example, the hygienic installation of services and conveyors, the control of material flow into the area; the provision of documented procedures for cleaning or disinfecting the area and the equipment; the control of personnel access and staff entry; optionally, the provision of documented rules regarding clothing and footwear, and so forth.

In a production facility, micro-organisms can be dispersed by aerosols consisting of particles dispersed in air. The particles are solid or liquid and may have micro-organisms inside or on their surfaces. Further, mould and bacterial spores are often airborne without being attached to dust or water droplets. Aerosols, mould and spores may enter a manufacturing area via drains, doorways and hatches, disinfection tunnels and compressed air supplies, or may be generated within a manufacturing area during cleaning and washing operations.

Preferably, in methods according to the present invention, a clean environment is provided by distributing, by means of an air handling system, fully conditioned air into the manufacturing area at the required rate and recirculating at least part of the the fully conditioned air through the system. By way of example, 85 percent of the fully conditioned air may be recirculated, the remaining 15 percent being exhausted and replenished. The expression "fully conditioned air" is used throughout this specification to describe a flow of air that has been filtered, the temperature and humidity of the air flow being controlled. Further details regarding the filtration of the air flow shall be provided below.

In addition, in methods according to the present invention, a clean environment may be provided by further introducing, by means of the air handling system, filtered fresh air into the manufacturing area during factory cleaning. This is intended to maintain an overpressure and protect the filters from moisture damage. Further, during periods of non-production, the air handling system may optionally supply into the manufacturing area filtered or fully conditioned air to maintain a specified pressure or temperature or both.

A clean environment has a controlled level of contamination that is specified by the number of particles per cubic metre at a specified particle size. Particle levels are usually tested using a particle counter and microorganisms detected and counted through environmental monitoring methods.
Clean room environments, for example, are classified according to the number and size of particles permitted per volume of air. The international standard ISO 14644-1 specifies the decimal logarithm of the number of particles 0.1 \( \mu \text{m} \) or larger permitted per cubic metre of air. So, for example, an ISO class 5 clean room has at most \( 10^5 = 100,000 \) particles per cubic metre.

A discrete-particle-counting, light-scattering instrument is used to determine the concentration of airborne particles, equal to and larger than the specified sizes, at designated sampling locations. ISO 14644-1 assumes log-log relationships between particle size and particle concentration.

As an example, the ambient air outside in a typical urban environment contains 35,000,000 particles per cubic meter in the size range 0.5 micron and larger in diameter, corresponding to an ISO 9 clean room, while an ISO 1 clean room allows no particles in that size range and only 12 particles per cubic meter of 0.3 micron and smaller.

Throughout this specification, by the term “clean environment” reference is generally made to a physically separated area (for example a room, or an enclosed portion of it) within a manufacturing facility, in which the concentration of airborne particles is controlled by cleaning the incoming air to the required level for the process and product requirements, by blanketing the product and process with clean air in an airflow pattern, and by using an air volume sufficient to eliminate contamination and maintain process integrity.

The packaging and sealing operations are preferably carried out in a clean environment provided with filters of the barrier type, such that the majority of microorganisms can be captured and retained in the filter media matrix. In more detail, the air entering a clean environment from outside is filtered to exclude dust, and the air inside is constantly re-circulated through high-efficiency particulate air (HEPA) or ultra-low penetration air (ULPA) filters or combinations of both HEPA and ULPA filters to remove internally generated contaminants, depending on the clean room class.

The European standard EN 779 (“Particulate air filters for general ventilation”) describes a laboratory test procedure based on the reproducible assessment of average arrestance of synthetic dust and minimum efficiency for 0.4 micrometers particles.

The European standard EN 1822 (High efficiency air filters – EPA, HEPA and ULPA) establishes a procedure for the determination of the filter efficiency on the basis of a particle counting method using a liquid test aerosol, and allows a standardised classification of filters in terms of their efficiency.

More preferably, the packaging and sealing operations are carried out in a clean environment provided with filters tested to a grade from F9 in accordance with the standard EN 779 to a grade H12 in accordance to the standard EN 1822. In some embodiments, clean environments may be kept at a positive pressure so that if there are any leaks, clean air may
leak out of the clean environment, thus preventing unfiltered air to enter. According to the invention, some clean environments may further provide with humidity, ventilation and air conditioning systems that control the humidity to such low levels such that extra equipment is necessary to prevent electrostatic discharge. Thus, the term “clean environment” is used to mean an environment that is not necessarily hermetically sealed or kept at a positive pressure, as long as substantially only filtered, sterile air is fed into the system.

The heating of the tobacco material is carried out before the tobacco material is packaged into packaging material. The tobacco material can therefore advantageously be heated to higher temperatures which may otherwise adversely affect the packaging material. Furthermore, a more homogeneous distribution of the heat throughout the tobacco material can thus advantageously be obtained. Preferably, the homogeneous distribution of the heat can be further improved by the use of an agitation means, such as for example a stirring means. Accordingly, the efficiency of the pasteurisation process is advantageously improved.

Since the packaging material is not subjected to the heating process, the packaging material can comprise containers of any structure, material and size, including very large containers. This provides flexibility in the appearance of the packaged product and the way in which the packaged product can be opened. At the same time, there is little risk of degradation or damage to the packaging material as a result of heat or moisture. This allows the use of a conventional appearance of the packaged product, for example for handling or marketing purposes. In particular, curling of any laminate structure, ink migration, shrinking, delamination, self-rupture, as well as deterioration of any printed, embossed or debossed portions in the packaging material are advantageously avoided. Furthermore, the likelihood of moisture condensing within the packaging material is additionally reduced. Accordingly, there is no need to provide overwrap material to prevent water from reaching accessible portions of the packaging material as may be the case if the packaging material was directly exposed to a heat exchange medium, such as water.

All packaging material, regardless of the specific size and type of the container, may receive exactly the same tobacco material having undergone the same heating process. Consistency of characteristics across the product portfolio can thereby be advantageously achieved.

The packaging material may be any suitable packaging material, including a box, a pouch, a bag, a tin or a bucket. Preferably, the packaging material is a flexible pouch as commonly known for tobacco products for the self assembly of smoking articles, such as roll-your-own and make-your-own tobacco products. Preferably, the packaging material is openable, closable and maybe reclosable or resealable by a consumer. Thus, the tobacco product can be accessed by the consumer and the packaging then closed or resealed to maintain an appropriate moisture level in the tobacco material.
The packaging material does not need to withstand high temperatures, because it is not subjected to the heating process of the pasteurisation. Preferably, the packaging material comprises plastic, metal or cardboard laminates or a combination thereof. More preferably, the packaging material is made of a laminate wherein at least one layer provides a moisture barrier. In other embodiments, the packaging material may provide a moisture barrier, without being made from a laminate material. This advantageously allows that, during the transport and while the product is kept on a shelf for storage and sale, evaporation of moisture from the tobacco material to the outside of the package is prevented. Accordingly, the moisture level in the tobacco product is maintained substantially constant.

The packaging material may be printed, embossed or debossed with branding material. Preferably, the packaging material is suitable for product sale to consumers.

The pasteurisation process reduces the number of viable microorganisms in the tobacco material. In particular, during the pasteurisation process, the mould count within the tobacco material is significantly reduced. Because the subsequent steps of packaging and sealing are performed within a clean environment, the pasteurised tobacco material is protected from factors which could adversely affect its quality, for example the ingress of microorganisms or moisture, environmental conditions and pollutants, etc. Accordingly, the shelf life of the packaged product is advantageously increased.

Preferably, the clean environment is provided by a packaging area including a plurality of packaging units. This may be achieved, for example, by providing as the packaging area a packaging room into which only clean, filtered or sterile air may enter. Further, it may be advantageous that the air inside is constantly re-circulated through filters to remove internally generated contaminants. The packaging room may have entrance and exit airlocks for the staff, and the equipment and furniture inside the room may be designed to generate minimal air contamination. Thus, the level of contamination can be effectively controlled in substantially the whole volume of the packaging room. The clean environment may, in addition, be provided as an area including clean packaging machinery. This may be achieved by controlling the level of contamination in a finite portion of a packaging room wherein the packaging unit is installed. To this purpose, it is important that the packaging unit has been properly designed and constructed to facilitate the maintenance and sanitation operations. Performance of the clean packaging unit may be controlled by having a planned maintenance schedule, which shall include measurements of temperature, pressure, humidity and particle count. Hygiene may be controlled by regular cleaning and, optionally, by regular disinfection, as appropriate to prevent the build up of dust, product or condensate that may provide a focus for microbial growth. As well as visual inspection, various microbiological methods of monitoring air quality are available.

The shape and functionality of a packaging unit may preferably be tailored for a particular type
of packaging material. Preferably, each packaging unit is preferably tailored for a particular type of packaging material, for example a metal and plastic laminate.

A single heating unit may be provided for several packaging units, for example for different packaging materials. As an alternative, an individual heating unit may be provided for each packaging unit.

Preferably, the step of heating the tobacco material comprises heating the tobacco material to between about 55 degrees Celsius and about 120 degrees Celsius. More preferably, the step of heating the tobacco material comprises heating the tobacco material to between about 60 degrees Celsius and about 85 degrees Celsius. In this temperature range, a particularly efficient pasteurisation can be carried out, and the mould count can be significantly reduced. At the same time, degradation of the tobacco due to the exposure to excessive heat can be advantageously avoided.

Preferably, the step of heating the tobacco material comprises heating the tobacco material for between about 30 seconds and about 30 minutes. More preferably, the step of heating the tobacco material comprises heating the tobacco material for between about 2 minutes and about 7 minutes. The heating can usually be carried out for a shorter period of time, if the heating temperature is high. Because the tobacco material is heated prior to being packaged and sealed, higher temperatures and shorter heating times can lead to an efficient, homogeneous pasteurisation of the whole of the tobacco material, without affecting its quality. In an embodiment, the tobacco material is heated to about 85 degrees Celsius for about 5 minutes.

Preferably, the step of heating the tobacco material comprises heating the tobacco material using a heating medium. In particular, the heating medium can be water, steam, air or an inert gas. For example, the heating medium may be a mixture of water micro-droplets and saturated steam. Alternatively, the heating medium may be a mixture of water, steam and air. In general, the heating medium may be a hot gas or a hot liquid vapour. Depending on the heat capacity of the heating medium, the amount of heat transferred to the tobacco material can be controlled. In particular, if a current is provided in the heating medium, it is preferable that the heating material reaches the whole of the tobacco material in order to favour a homogenous heat distribution.

In a preferred embodiment, the tobacco material is heated by means of electromagnetic radiation. The wavelength and frequency of the electromagnetic radiation can be selected according to the specific application in order to transfer an appropriate amount of heat to the tobacco material. The use of electromagnetic radiation to heat the tobacco material can advantageously reduce the time necessary for the heating step.

In a particularly preferred embodiment, the tobacco material is heated by means of microwave or radiofrequency dielectric heating. This may be particularly beneficial where the
tobacco material comprises a significant moisture level, so that the microwave or radiofrequency field will be able to quickly heat up the dielectric component of the tobacco, for example water. The applied electromagnetic field power is preferably controlled to achieve uniform heating and pasteurisation of the tobacco material by temperature measurement and control of electromagnetic field generator power during continuous processing of the filled inner pouches. The applied electromagnetic field power may be controlled to achieve uniform heating and pasteurisation of the tobacco by control of electromagnetic field generator power for successive microwave heating steps. Preferably, the control is taking into account the specific product parameters of the tobacco material being treated, such as water content. Preferably, the specific product parameters of the tobacco material are predefined or determined by according sensors. In one embodiment, the applied electromagnetic field power is controlled based on measurements of the temperature inside the closed inner pouch, to prevent the creation of hot or cold spots during pasteurisation. The electromagnetic field power may be applied in at least two heating stages, taking into account the specific product parameters. Thus, the creation of hot spots during the heating process can advantageously be avoided.

In some embodiments, the heating may be carried out at a pressure above atmospheric pressure. By compressing the tobacco material, the space between the individual tobacco particles is reduced, therefore heat conduction can occur faster. In other embodiments, the heating may be carried out at atmospheric pressure. The pressure during the heating is preferably controlled in dependency of the temperature of the treatment and the nature of the heating medium.

Preferably, after the step of heating the tobacco material, a step of cooling the tobacco material may be carried out. For example, the tobacco material may be subjected to a cooling medium, such as cold air or an inert gas. Depending on the heat capacity of the cooling medium, the duration of the cooling step may be adjusted by varying the amount of cooling medium. Preferably the temperature reached by the tobacco material during the cooling step is monitored. Further, a current in the cooling medium such as generated by a pump or a fan may be beneficial. For example, the tobacco material may be cooled to a temperature lower than ambient temperature. Accordingly, the tobacco can be maintained at the lower temperature level, which helps to preserve tobacco so that a longer storage and shelf life for the packaged product is achieved. In particular, after the cooling, packaging and sealing operations, the packaged tobacco product may be distributed while being chilled, especially transported in a chilled state. Further, chilled storage of the packaged tobacco product after or before transportation may be applied.

The tobacco material may include one of different tobacco types or mixtures thereof and may be provided in any suitable form.
Preferably, the tobacco material is a fine-cut tobacco material. Preferably, the fine-cut tobacco material has a cut width of between about 0.2 mm and about 0.9 mm, more preferably between about 0.5 mm and 0.9 mm. The fine-cut tobacco is intended for combustible use. In particular, the fine-cut tobacco material having a cut width within these preferred ranges is particularly suitable for use in the self assembly of combustible smoking articles, for example for use as a roll-your-own or make-your-own tobacco product. The cut width is particularly important for tobacco materials intended for the assembly of combustible smoking articles by the consumer, in particular cigarettes, which require strips or strands of a certain size in order to prevent the tobacco from falling out of the open end of the cigarette. The cut width of the fine-cut tobacco material is also important to control the combustion process of the tobacco material and to ensure a suitable resistance-to-draw during combustion of a cigarette formed from the fine-cut tobacco material. Preferably, the strands of the fine-cut tobacco material have a length of between about 6 mm and about 75 mm.

The size of the strips of fine-cut tobacco material is in contrast to the form of snus tobacco, for which the tobacco is mostly ground or more finely cut and does not fall within the ranges indicated above. Reducing the tobacco into this type of fine pulp has a significant effect on the tobacco, for example, on its cell structure or release of essential oils, compared with a more macroscopic cutting of the leaves into parallel strip of a distinctive width as well as the burning and other handling of the tobacco.

Typically, the fine-cut tobacco material is unfermented or free of salt, or both and preferably the fine-cut tobacco material is not treated in the same way as snus product. However, the fine-cut tobacco material may comprise leaf that has been fermented before cutting. In certain preferred embodiments, the fine-cut tobacco material consists only of the strips of tobacco leaf and includes little or no other additives. Preferably, the tobacco material is free from preservatives. The lack of additives such as preservatives is one of the main reasons why the pasteurisation of the tobacco material is advantageous.

Preferably, the moisture content of the tobacco material is between about 15 percent and about 21 percent by weight, more preferably between about 15 percent and about 18 percent by weight. It is desirable to provide the tobacco material within this relatively high moisture range since this makes the strands of tobacco less brittle and facilitates rolling of the tobacco material into a tobacco rod during the self assembly of a smoking article by the consumer. The desired moisture level is typically set during tobacco processing through the appropriate addition of water or the appropriate drying conditions or a combination of both addition of water and drying conditions.

The tobacco material optionally includes a humectant in order to ensure that the moisture level is retained. Suitable humectants include, for example, glycol and glycerine. Preferably, the tobacco material comprises up to about 9 percent by weight of a humectant.
The packaged tobacco product preferably has a weight of between about 10 grams and about 500 grams, more preferably between about 30 grams and about 100 grams.

According to another aspect of the invention there is further provided an apparatus for the handling of tobacco material, the apparatus comprising a heating unit for heating the tobacco material such that the tobacco material is pasteurised; and a clean environment including at least one packaging unit for packaging the pasteurised tobacco material into packaging material and sealing the packaging material. Further, according to yet another aspect of the invention there is provided a packaged tobacco product manufactured using the method or apparatus of the other aspects of the present invention. Features described in relation to the first aspect of the invention may also be applicable to this aspect of the invention.

The invention will be further described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic view of an apparatus for the handling of tobacco material according to a first embodiment of the present invention;

Figure 2 is a schematic view of an apparatus for the handling of tobacco material according to a second embodiment of the present invention; and

Figure 3 is a schematic view of an apparatus for the handling of tobacco material according to a variant of the second embodiment of Figure 2.

Figure 1 is a schematic view of an apparatus 100 for the handling of tobacco material according to a first embodiment of the present invention. The apparatus 100 comprises a heating unit 101 for heating tobacco material such that the tobacco material is pasteurised, and a clean environment 102. In particular, the clean environment 102 is provided as a packaging room including a plurality of packaging units 103, 103', 103" adapted to package the pasteurised tobacco material into packaging material and seal the packaging material. The packaging units 103, 103', 103" are tailored for respective types of packaging material (for example pouch, bag or tin). The packaging room 102 has entrance and exit airlocks 104. In use, once pasteurised in the heating unit 101, the tobacco material may be transferred to any of the packaging units 103, 103', 103" in the packaging room to be packaged. Thus, a single heating unit (that is, a single pasteurisation unit) may serve several packaging units.

Figure 2 is a schematic view of an apparatus 200 for the handling of tobacco material according to a second embodiment of the present invention. The apparatus 200 comprises a heating unit 201 for heating tobacco material such that the tobacco material is pasteurised, and a clean environment 202. In particular, the clean environment 202 is provided as a clean area including an individual packaging unit 203. The clean environment 202 is included within a packaging room further accommodating other packaging units 203', 203". The packaging unit 203 is tailored for a specific type of packaging material, for example pouch. In use, once pasteurised in the heating unit 201, the tobacco material is transferred to the packaging units
203 to be packaged. Thus, the method of the present invention is selectively implemented for a specific type of packaging material. It will be appreciated by the skilled person that a dedicated heating unit may be provided for each packaging unit.

Figure 3 is a schematic view of an apparatus 300 for the handling of tobacco material according to a variant of the embodiment of Figure 2. The apparatus 300 comprises a heating unit 301 for heating tobacco material such that the tobacco material is pasteurised, and a clean environment 302. In particular, the clean environment 302 is provided as a clean area including an individual packaging unit 303. The clean environment 302 is included within a packaging room further accommodating other packaging units 303', 303". The packaging unit 303 is tailored for a specific type of packaging material, for example pouch. The heating unit 301 is also arranged within the same packaging room and in the vicinity of the packaging unit 303. In use, once pasteurised in the heating unit 301, the tobacco material is directly transferred to the packaging unit 303 to be packaged. Thus, the pasteurisation process may be carried out immediately before the packaging operation. It will be appreciated by the skilled person that a dedicated heating unit may be provided for each packaging unit.

Alternatively to the above described embodiments, the heater 100, 200, 300 may also be comprised in the clean environment 102, 202, 302.
CLAIMS

1. A method of handling tobacco material, the method comprising the steps of:
   heating the tobacco material such that the tobacco material is pasteurised;
   packaging the pasteurised tobacco material into packaging material; and
   sealing the packaging material,
wherein the step of heating is performed before the steps of packaging and sealing, and the
steps of packaging and sealing are performed within a clean environment.

2. A method according to claim 1, wherein the clean environment is provided by a clean
   room packaging area including a plurality of packaging units.

3. A method according to claim 1 or 2, wherein the clean environment comprises a clean
   packaging machinery.

4. A method according to any preceding claim, wherein the step of heating the tobacco
   material comprises heating the tobacco material to between about 55 degrees Celsius and
   about 120 degrees Celsius.

5. A method according to any preceding claim, wherein the step of heating the tobacco
   material comprises heating the tobacco material for between about 30 seconds and about 30
   minutes.

6. A method according to any preceding claim, wherein the step of heating the tobacco
   material comprises heating the tobacco material using a heating medium.

7. A method according to any preceding claim, wherein the step of heating the tobacco
   material comprises using microwave radiation.

8. A method according to any preceding claim, further comprising, after the step of heating
   the tobacco material, cooling the tobacco material.

9. A method according to any preceding claim, wherein the tobacco material comprises
   fine-cut tobacco.

10. A method according to claim 9, wherein the fine-cut tobacco has a cut width of between
    about 0.3 mm and about 0.9 mm.
11. A method according to any preceding claim, wherein the tobacco material has a moisture content between about 15 percent by weight and about 21 percent by weight, preferably, between about 15 percent by weight and about 18 percent by weight.

12. A method according to any preceding claim, wherein the tobacco material includes a humectant.

13. Apparatus for the handling of tobacco material, the apparatus comprising:
   a heating unit for heating the tobacco material such that the tobacco material is pasteurised;
   a clean environment including at least one packaging unit for packaging the pasteurised tobacco material into packaging material and sealing the packaging material.

14. Apparatus according to claim 13, wherein the sealed environment comprises a packaging area including a plurality of packaging units.

15. A packaged tobacco product manufactured according to the method of any of claims 1 to 12 or by the apparatus of any of claims 13 to 14.