	TITLE: GUIDELINES FOR HYGEINIC PREPARATION OF HERBAL PRODUCTS AND NUTRACEUTICALS	
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Pharmacy Board of Sierra Leone,

PMB 322

Central Medical Stores Compound

New England Ville

Freetown

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

These guidelines are for the interest of individuals intending to engage in the manufacturing of herbal medicines and related products in Sierra Leone. It prescribes the minimum Good Manufacturing practice (GMP) requirements for the facilities and controls to be used in the manufacture of herbal medicines and related products to ensure quality and safety.

This document also prescribes the minimum requirements necessary for inspection of a facility for compliance with Good Manufacturing Practices for the registration of traditional medicines and related products. It is necessary to emphasize that, no herbal medicines and related products should be manufactured, imported, exported, advertised, sold or distributed in Sierra Leone unless it has been registered in accordance with the provisions of the Pharmacy and Drug Act and the accompanying guidelines. All herbal medicines and related products should not be manufactured in Sierra Leone unless the facility has been inspected and found to comply with Good Manufacturing Practices.

Herbal medicines and related products are products that contain exclusively active ingredients of one or more herbal substances or one or more herbal preparations, or one or more such herbal substances in combination with one or more such herbal preparations presenting with therapeutic and prophylactic claims. Herbal medicines and related products may include natural plant substances such as seeds, berries, roots, leaves, bark, rhizomes, flowers, fruit bodies or other parts presented as herbs, herbal materials, herbal preparations and finished herbal products.

The production, processing, and packing of herbal medicines and related products are very complex. For example, source plants for herbal medicines and related products are mostly from the wild. Drying of source plants may be performed mechanically (for rapid drying) or naturally (e.g. slower drying under the sun for several days). The distribution and processing chain for these products is also highly complex and can span long periods of time and include a wide range of establishments. The raw materials pass through multiple stages of collection and consolidation before reaching the manufacturer. Dried product processing generally involves cleaning (e.g. culling, sorting to remove debris), grading, sometimes soaking, slicing, drying, and on occasion grinding/cracking. Some herbs are also treated to mitigate microbial contamination, typically by steam treatment, gas

treatment (e.g. ethylene oxide), or irradiation. Processing and packing/repacking may also take place in multiple locations over long periods of time.

The safety of these products depends on maintaining good hygienic practices along the manufacturing chain during primary production, processing, packing, retail, and at the point of consumption. Spore forming bacteria, including pathogens such as Bacillus cereus, Clostridium perfringens, and Clostridium botulinum, as well as non-spore forming vegetative cells of microorganisms such as Escherichia coli, Staphylococcus aureus, and Salmonella spp. have been found in raw materials for the production of herbal medicines and related products. The complex supply chain for herbal medicines and related products makes it difficult to identify the points in the manufacturing chain where contamination occurs, but evidence has demonstrated that contamination can occur throughout the manufacturing chain if proper practices are not followed.

The safety of dried herbal medicines and related products can also be affected by mycotoxin-producing moulds, e.g. those producing aflatoxin (such as Aspergillus flavus or Aspergillus parasiticus) or ochratoxin A (such as Aspergillus ochraceus, Aspergillus carbonarius, or Penicillium verrucosum). Chemical hazards such as heavy metals and pesticides, as well

as physical contaminants such as stones, glass, wire, extraneous matter and other objectionable material, may also be present in herbal medicines and related products

2.0 OBJECTIVES

This Code of Hygienic Practice addresses Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs) that will help minimize contamination, including microbial, chemical and physical hazards, associated with all stages of the production of herbal medicines and related products from primary production to consumer use. Particular attention is given to minimizing microbial hazards.

3.0 SCOPE

This guideline applies to all natural plant substances such as seeds, berries, roots, leaves, bark, rhizomes, flowers, fruit bodies or other parts presented as herbs, herbal materials, herbal preparations and finished herbal products. It covers the minimum requirements of hygiene for growing, harvesting and post-harvest practices (e.g. curing, bleaching, blanching, cutting, drying, cleaning, grading, packing, transportation and storage, including

disinfestation and fumigation) processing establishment, processing technology and practices (e.g. grinding, blending, freezing and freeze-drying, treatments to reduce the microbial load) packaging and storage of processed products. For raw materials collected from the wild, only the measures for handling and post-harvest activities apply.

4.0 SPECIFIC REQUIREMENTS

4.1 PRIMARY PRODUCTION

4.1.1 Environmental Hygiene

Source plants from which raw materials are derived for the production of herbal medicines and related products should be protected, to the extent practicable, from contamination by human, animal, domestic, industrial and agricultural wastes which may be present at levels likely to be a risk to health. Adequate precautions should be taken to ensure that these wastes are disposed of in a manner that will not contaminate the source plants and constitute a health hazard to consumers of the final product.

4.1.2 Location of the production site

The proximity of production sites that pose a high risk for contamination of source plants, such as animal production facilities, hazardous waste sites

and waste treatment facilities, should be evaluated for the potential to contaminate production fields for source plants with microbial or other environmental hazards.

Consideration of production site location should include an evaluation of the slope and the potential for runoff from nearby fields, the flood risk as well as hydrological features of nearby sites in relation to the production site.

When the environmental assessment of the site of production identifies a potential contamination risk, measures should be implemented to prevent or minimize contamination of source plants at the production site.

Many wild and domestic animal species and humans that may be present in the production environment are known to be potential sources of foodborne pathogens. Domestic and wild animals and human activity can present a risk both from direct contamination of the crop and soil as well as from contamination of surface water sources and other inputs. The following should be considered:

Domestic and wild animals should be excluded from production and handling areas, to the extent possible, using appropriate control methods. Methods selected should comply with environmental and animal protection regulations.

If animals are used in the harvest of source plants, care should be taken to ensure that the animals do not become a source of contamination, e.g. by animal faeces.

Production and handling areas for source plants should be properly maintained to reduce the likelihood of pest attraction. Activities to consider include efforts to minimize standing water in fields, to restrict access by animals to water sources, and to keep production sites and handling areas free of waste and clutter.

Source plant production sites and handling areas should be evaluated for evidence of the presence of wildlife or domestic animal activity (e.g. presence of animal faeces, large areas of animal tracks, or burrowing).

4. 1.3 Hygienic production of herbal medicines and related products

Source plants should be grown, harvested and cleaned of extraneous matter in accordance with Good Agricultural Practices.

Arrangements for the disposal of domestic and industrial wastes in areas from which raw materials are derived should be acceptable to the competent authorities.

4.2 AGRICULTURAL INPUT REQUIREMENTS

4.2.1 Water for primary production

Source plants should not be grown or produced in areas where the water used for irrigation might contaminate plants. Growers should identify the sources of water used on the farm (e.g. municipal water, well water (deep vs. shallow), surface water (e.g. rivers, reservoirs, ponds, lakes, open canals) re-used irrigation water, reclaimed wastewater, discharge water from aquaculture. It is recommended that growers assess and, where practicable, manage the risk posed by these waters as follows:

Assess the potential for microbial contamination (e.g. from livestock, human habitation, sewage treatment, manure and composting operations) and the water's suitability for its intended use. Reassess the potential for microbial contamination if events like, environmental conditions (e.g. temperature fluctuations, heavy rainfall, etc.) or other conditions indicate that water quality may have changed.

Assess the potential for chemical contamination (e.g. from mine drainage, agricultural run-off, industrial waste) and the water's suitability for its intended use. Reassess the potential for chemical contamination if events or environmental or other conditions indicate that water quality may have changed.

Identify and implement corrective actions to prevent or minimize contamination. Possible corrective actions may include fencing to prevent large animal access, properly maintaining wells, filtering water, not stirring the sediment when drawing water, building settling or holding ponds, and water treatment facilities. Settling or holding ponds that are used for subsequent irrigation may be microbiologically safe, but may attract animals or in other ways increase the microbial risks associated with water for irrigating plants. If water treatment is needed, consult with water safety experts.

Determine if microbial and chemical analysis should be done to evaluate the suitability of water for each intended use. Analytical testing may be necessary after a change in irrigation water source, flooding or a heavy rainfall when water is at a higher risk of contamination.

4.2.2 Agricultural chemicals

Growers should only use agriculture chemicals according to the procedures authorized by the competent authorities. In addition: Soil fungicides may be used on seedbeds or fields if necessary to reduce the amount of spores of mycotoxin-producing moulds.

If appropriate, for preventive purposes, fungicides may be used on source plants, e.g. fruits, to avoid the introduction of mycotoxin-producing moulds

4.2.3 Personnel health, hygiene and sanitary facilities

The following should be considered:

Where appropriate, each business engaged in primary production operations should have written procedures that relate to health, hygiene and sanitary facilities. The written procedures should address worker training, facilities and supplies to enable agricultural workers to practice proper hygiene, and company policies relating to expectations for worker hygiene as well as illness reporting.

All agricultural workers should properly wash their hands using soap and clean running water, followed by thorough drying, before handling source plants or dried raw materials, particularly during harvesting and post-harvest handling. If running clean water is not available, an acceptable alternative hand washing method should be used. Agricultural workers should be trained in proper techniques for hand washing and drying.

Non-essential persons, casual visitors and, to the extent possible, children, should be deterred from entering the harvest area as they may present an increased risk of contamination. When such persons are present, care should be taken to ensure they do not become a source of contamination.

4.2.4 Personnel hygiene and sanitary facilities

Growers should consider providing, where practicable, areas away from the growing/harvest area for agricultural workers to take breaks and eat. For worker convenience, these areas should provide access to toilet and hand-washing and drying facilities so agricultural workers can practice proper hygiene.

As far as possible, sanitary facilities should be readily accessible to the work area.

Sanitary facilities should be located in a manner to encourage their use and reduce the likelihood that agricultural workers will relieve themselves in the growing/harvest area.

Portable facilities (if used) should not be located or cleaned in cultivation areas or near irrigation water sources or conveyance systems. Growers should identify the areas where it is safe to put portable facilities and to prevent traffic in case of a spill.

Facilities should include clean running water, soap, toilet paper or equivalent, and single use paper towels or equivalent. Multiple use cloth drying towels should not be used. Hand sanitizers should not replace hand washing and should be used only after hands have been washed.

4.2.5 Health status

The following should be considered:

Growers should be encouraged to observe symptoms of diarrheal or food-transmissible, communicable diseases and reassign agricultural workers to duties that do not involve direct handling of raw materials as appropriate.

Workers should be encouraged and, where feasible, be motivated with appropriate incentives to report symptoms of diarrheal or food-transmissible, communicable diseases.

Medical examination of workers should be carried out if clinically or epidemiologically indicated.

4.2.6 Personal cleanliness

When personnel with cuts and wounds are permitted to continue working, the injury should be covered by water-proof dressings firmly secured. In addition, there should be a secondary barrier between the cut or wound and the source plants handled, such as gloves or protective clothing, to cover the water-proof dressing.

4.3 HANDLING, STORAGE AND TRANSPORT

Each source plant should be harvested using a method suitable for the plant part to be harvested in order to minimize damage and the introduction of

contaminants. Plant matter that is damaged or other plant waste material should be disposed of properly and removed from the growing/harvest area in order to minimize the potential for it to serve as a source of mycotoxin-producing moulds. If possible, only the amount that can be processed in a timely manner should be picked in order to minimize growth of mycotoxin-producing moulds prior to processing. When the amount harvested exceeds processing capabilities, the excess should be stored under appropriate conditions.

4.3.1 Prevention of cross-contamination

Specific control methods should be implemented to minimize the risk of cross-contamination from microorganisms associated with harvesting methods. The following should be considered:

Where appropriate, the soil under the plant should be covered with a clean sheet of plastic or clean plant material such as straw during picking/harvest to avoid contamination by dirt or plant matter that has fallen prior to harvesting. Plastic that will be reused should be easy to clean and disinfected. Plant material should be used only once.

Source plant material that has fallen to the ground should be disposed of properly if it cannot be made safe by further processing.

4.3.2 Storage and transport from the growing/harvest area to the packing establishment

The containers and conveyances for transporting the source plant material or herbal medicines and related products from the place of production to storage or processing should be cleaned and disinfested, as appropriate, before loading. Products should be protected, where practicable, against outdoor conditions when transported.

Prevent field debris from entering packing and storage facilities by cleaning the outside of harvest bins and requiring workers to wear clean clothes in those areas.

The raw materials from the source plant should be kept in areas where contact with water or moisture is minimized.

Raw materials should be stored on raised platforms or hung under a non-leaking roof in a cool dry place. The storage location should prevent access, to the extent practicable, by rodents or other animals and birds and should be isolated from areas of excessive human or equipment traffic.

4.3.3 Drying

4.3.3.1 Natural Drying

The drying method use should provide a reduction of contamination with Polycyclic Aromatic Hydrocarbons (PAH) from Smoking and Direct Drying Processes with regard to the location of the drying area.

Plants or parts of plants used for the preparation of herbal medicines and related products may be dried naturally, e.g. air dried, provided adequate measures are taken to prevent contamination of the raw material during the process. The drying time depends on the environmental conditions surrounding the product, i.e. temperature, relative humidity, and air velocity.

If dried naturally, plants or parts of plants should be dried on clean, elevated racks, clean concrete floors, or clean mats or tarps or by hanging under a non-leaking roof and not on the bare ground or in direct contact with the soil. Pathways should be made in the drying area to prevent anyone from walking on the crop. The drying plant material should be raked/turned frequently to limit moulds growth.

Concrete floors or slabs poured specifically for drying source plants should be subject to an appropriate cleaning program and, where appropriate,

disinfected. New concrete slabs should be used for drying only when it is absolutely certain that the new concrete is well-cured and free of excess water. A suitable plastic cover spread over the entire new concrete slabs can be used as a moisture barrier; however, the sheet should be completely flat to prevent the pooling of water. Suitable precautions should be taken, where practicable, to protect the raw material from contamination and damage by domestic animals, rodents, birds, mites, insects or other objectionable substances during drying, handling and storage. If drying outdoors, drying platforms should be placed under a roof/tarp free of tears, holes or frayed material that will prevent rewetting by rainfall and contamination from birds overhead. Drying time should be reduced as much as possible by using optimal drying conditions (e.g. temperature, humidity and ventilation) to avoid fungal growth and toxin production. The thickness layer of the drying source plant material should be considered in order to consistently achieve a safe moisture level.

4.3.3.2 Mechanical drying (see Section 4.6.2.1.1)

4.3.4 Packing in the growing/harvest area

Packing activities can occur in the growing/harvest area. Such packing operations should include the same sanitary practices, where practical, as packing raw materials in establishments or modified as needed to minimize

risks. To prevent germination and growth of spores, the products must be dried to a safe moisture level prior to packing.

When packing raw materials in the growing/harvest area for transport, storage, or for further sale, new bags should be used to prevent the potential for microbial, physical and chemical contamination. When bags are marked, food-grade ink should be used to minimize the potential for contamination with ink. When bags have an open structure, such as jute bags, the bag should not be marked when filled with raw materials to prevent liquid ink from contaminating the contents and increasing the moisture in the spices and dried aromatic herbs. It is recommended that paper tags be used instead of liquid ink for marking.

Removal of discarded plant material should be done on a regular basis in order to avoid accumulation that would promote the presence of pests.

4.4 CLEANING, MAINTENANCE AND PERSONNEL HYGIENE AT PRIMARY PRODUCTION

4.4.1 Cleaning programs

The following should be considered:

Harvesting equipment, including knives, pruners, machetes, that come into direct contact with source plants should be cleaned at least daily or as the situation warrants and, when necessary, disinfected.

Clean water should be used to clean all equipment directly source plant, raw material, including farm machinery, harvesting and transportation equipment, containers and knives.

Equipment should be allowed to dry before use.

4.4.2 Cleaning procedures and methods

Cleaning and disinfection programs should not be carried out in a location where the rinse water might contaminate source plant material.

4.5 ESTABLISHMENT: DESIGN AND FACILITIES

4.5.1 Premises and rooms

Where practicable, buildings and facilities should be designed to provide separation, by partition, location or other effective means, between operations that could result in cross contamination. They should be designed to facilitate hygienic operations according to the one-way flow direction, without backtracking, from the arrival of the raw materials at the premises to the finished product, and should provide for appropriate temperature conditions for the process and the product.

The application of appropriate hygienic design standards to building design and layout is essential to ensure that contaminants are not introduced into the product. Hygienic design should ensure that if a pathogen such as Salmonella spp. is introduced it does not become established in specific areas that can serve as a source of contamination of the product. Premises and rooms used for dried source plant should be physically separated from wet processing areas and designed such that they can be cleaned routinely with little or no water, when wet cleaning is required, premises and rooms should be thoroughly dried before introducing dried raw materials.

Since limiting water is the primary means to control microbial growth from pathogens such as Salmonella spp. or mycotoxin-producing moulds in establishments processing and packing herbal medicines and related products, premises and rooms should be designed to exclude moisture from the environment. In general, areas in which herbal medicines and related products are handled should not have drains; however, if drains are present, the surrounding floor should be properly sloped for effective drainage and kept dry under normal conditions.

Procedures should be established to inspect the integrity of the establishment (e.g. for roof leaks); such problems should be corrected as soon as they are detected.

Proper ventilation should be in place to correctly manage temperature, humidity and dust in the establishment. Calibrated electronic sensors may be used to monitor temperature and humidity. In addition, airflow in the establishment should provide for higher air pressures in the packaging areas and lower air pressures in rooms where incoming materials are handled. Exhaust vents should be hygienically designed to prevent the formation and accumulation of condensation around the vent exit and to prevent water from re-entering the establishment. Exhaust ducts should be cleaned on a regular basis and should be designed to prevent reverse air flow.

Premises and rooms should be designed with a means of dust control, since herbal medicines and related products are likely to generate particulate matter that can be carried to other parts of the room or premises by air currents.

Elevated infrastructure should be designed to minimize the accumulation of dust and dry material, especially when pipes, overhead structures and platforms are directly above exposed herbal medicines and related products.

Construction and major maintenance activities can dislodge microorganisms from harbourage sites where they have become established and lead to widespread contamination of the establishment. Because some microorganisms such as Salmonella spp. can survive in dry environments for

long periods of time, construction activities may release these microorganisms from hidden harbourage sites. Preventative measures such as temporary isolation of the construction or maintenance sites, rerouting of employee and equipment traffic, proper handling of construction material entry and waste material egress, maintaining negative pressure in the work site, and other appropriate measures should be implemented during construction and maintenance.

4.5.2 Equipment

Equipment should be designed to facilitate cleaning and disinfection with little or no water and, when wet cleaning is required, to allow thorough drying before reusing the equipment. Alternatively the design should allow disassembly such that parts can be taken to a room designed for wet cleaning and disinfection, when applicable. The equipment design should be as simple as possible, with a minimal number of parts and with all parts and assemblies easily accessible and/or removable for inspection and cleaning. Equipment should not have pits, cracks, corrosion, crevices, recesses, open seams, gaps, lap seams, protruding ledges, inside threads, bolt rivets, or dead ends.

Hollow areas of equipment as well as cracks and crevices should be eliminated whenever possible or permanently sealed. Items such as bolts,

studs, mounting plates and brackets should be continuously welded to the surface and not attached via drilled and tapped holes. Welds should be ground and polished smooth.

Push buttons, valve handles, switches and touch screens should be designed to ensure product and other residues (including liquid) do not penetrate or accumulate in or on the enclosure or interface.

Equipment should be installed so as to allow access for cleaning and to minimize transfer of dust particles to other pieces of equipment or to the environment.

The risk of contamination from equipment should be assessed and controlled. Wherever possible, forklifts, utensils, and maintenance tools for the finished product and packaging areas should be different from those used in the "raw" material area (e.g. prior to the microbial reduction treatment).

4.5.3 Facilities

4.5.3.1 Storage

Most raw materials and herbs are susceptible to mould contamination and/or growth if storage conditions are not appropriate. Raw materials especially

when dried should be stored in an environment with humidity that does not result in product moisture that can support the growth of moulds.

4.6 CONTROL OF OPERATION

4.6.1 Control of product hazards

Measures should be taken at each step in the manufacturing chain to minimize the potential for contamination of the raw material by microbial pathogens (including mycotoxin-producing moulds), chemical contaminants, excreta, rodent hair, insect fragments and other foreign materials.

Depending on the activities conducted at the establishment, it may be useful to separate the establishment into areas or zones, such as the raw material (pre-processing) area and the post-processing area, with stricter controls in areas post-processing where a microbial reduction treatment has been delivered and in the areas where product is being packaged.

Traffic patterns should be established with respect to movement of personnel and materials (e.g. ingredients used in dry-mixing, packaging materials, pieces of equipment, carts and cleaning tools) according to the one-way flow direction, without backtracking, with partitioning/separation of operations in order to minimize tracking of materials from other areas, e.g.

the raw material area to the finished product area, in order to prevent cross-contamination.

Should the raw materials become contaminated with a pathogen such as Salmonella spp., the pathogen can become established in a specific area. If the harbourage site becomes wet, the pathogen can grow to large numbers and the harbourage site can serve as a source of contamination to other places in the establishment, including product contact surfaces and products exposed to the environment. Therefore, potential harbourage sites should be identified and kept as dry as possible.

In the case of an unusual event, such as a roof leak or a faulty sprinkler that introduces water into the dry production or packaging environment, production should be stopped. The leak should be fixed, and the area cleaned, disinfected and dried before production resumes. Products damaged from the unusual event should be evaluated based on risk and, where appropriate, properly treated or kept from entering the food chain.

4.6.2 Key aspects of hygiene control systems

4.6.2.1 Specific process steps

4.6.2.1.1 Mechanical Drying

Plants or parts of plants used for the preparation of herbal medicines and related products may be dried mechanically (e.g. forced air drying), provided adequate measures are taken to prevent contamination of the raw material during the process. To prevent the growth of microorganisms, especially mycotoxin-producing moulds, a safe moisture level should be achieved as rapidly as possible.

Mechanical drying methods should be used instead of natural (open) air drying, where possible, to limit exposure of the raw materials to environmental contaminants and to prevent growth of moulds. If hot air drying is used, the air should be free of contaminants and precautions should be made to prevent combustion gases from contacting the plant material or stored plant material in the area.

Drying time should be reduced as much as possible by using optimal drying conditions to avoid fungal growth and toxin production. The thickness layer of the drying source plant should be considered in order to consistently achieve a safe moisture level.

4.6.2.1.2. Cleaning of raw materials

Raw materials should be cleaned properly (e.g. culled and sorted) to remove physical hazards (such as the presence of animal and plant debris, metal and other foreign material) through manual sorting or the use of detectors, such as metal detectors. Raw materials should be trimmed to remove any damaged, rotten or mouldy material.

Debris from culling and sorting should be periodically collected and stored away from the drying, processing and packaging areas to avoid cross-contamination and attracting pests.

4.6.2.1.3 Microbial Reduction Treatments

In order to control microbiological contamination, appropriate methods of treatment may be used in accordance with the regulations set by the competent authority. When necessary to reduce risk, raw materials should be treated with a validated microbial reduction treatment prior to reaching the consumer in order to inactivate pathogens such as Salmonella. Commonly used methods involve the application of steam, fumigation or radiation.

Factors that should be controlled when using steam include exposure time and temperature. The process should ensure that all of the product achieves

the desired temperature for the full length of time required. A drying step may be necessary to remove added moisture.

Factors that should be controlled when using irradiation include radiation dose and the size and shape of the package, as well as the penetrability of the packaging material to the type of radiation used. The process should ensure that all of the product is exposed to the minimum dose of radiation needed to provide the intended effect.

Factors that should be controlled when using fumigation treatments such as ethylene oxide or propylene oxide include chemical concentration, exposure time, vacuum and/or pressure, density of the product, and gas permeability of the packaging material. The process should ensure that all products are directly exposed to the gas for the full length of time required.

For pathogen inactivation treatments the adequacy of the selected control measure (thermal or non-thermal) and associated critical limits for processing should be determined, considering the increased heat resistance reported for Salmonella at low water activities and the increased resistance of spores to most microbial reduction treatments. In some cases, challenge studies may be needed to support validation. Once the lethality of the process is validated by scientific data, the establishment should periodically verify that the process continues to meet the critical limits during operation

and the process criteria intended to achieve microbiocidal effects in the establishment.

4.6.2.2 Microbiological and other specifications

Where appropriate, specifications for pathogenic and toxigenic microorganisms, chemical residues, foreign material, and decomposition should be established that take into account subsequent processing steps, the end use of the herbal medicine or related product and the conditions under which the product was produced.

When tested by appropriate methods of sampling and examination, the products should:

Be free from pathogenic and toxigenic microorganisms in levels that may not present a risk to health; and should comply with the provisions for drug/food additives;

Not contain any substances originating from microorganisms, particularly mycotoxins, in amounts that exceed the acceptable tolerance levels;

Not contain levels of insect, bird or rodent contamination that indicate that the final products have been prepared, packed or held under unhygienic conditions;

Not contain chemical residues resulting from the treatment of the raw materials in excess of the acceptable levels;

Comply with the provisions for contaminants, and with maximum acceptable levels for pesticide residues.

In view of the limitations of end-product testing, herbal medicines and related products safety should be assured through the design of an appropriate safety control system and by verification of the implementation of the system and the effectiveness of the control measures e.g. through appropriate Quality Assurance or Quality Control auditing methods.

Microbiological testing can be a useful tool to evaluate and verify the effectiveness of safety and sanitation practices, provide information about an environment, a process, and even a specific product lot, when sampling plans and methodology are properly designed and performed. The intended use of information obtained (e.g. evaluating the effectiveness of a sanitation practice, evaluating the risk posed by a particular hazard, etc.) can aid in determining what microorganisms are most appropriate to test for. Test methods validated for the intended use should be selected. Consideration should be given to ensure proper design of a microbiological testing program. Trend analysis of testing data should be undertaken to evaluate the effectiveness of safety control systems. Verification activities may

include, as necessary, appropriate environmental and/or product testing. When monitoring control measures and verification results demonstrate deviations, appropriate corrective action should be taken and the finished product should not be released until it is shown that it complies with appropriate specifications.

4.6.2.3 Microbiological cross-contamination

Effective measures should be taken to prevent cross-contamination of uncontaminated raw materials or finished products by direct or indirect contact with potentially contaminated material at all stages of the processing. Raw products that may present a potential hazard should be processed in separate rooms, or in areas physically separate from those where end-products are being prepared. Raw materials or products that have undergone a microbial reduction treatment should be processed and stored separately from untreated ones. Equipment should not be used for both treated and untreated products without adequate cleaning and disinfection before use with treated products.

Persons handling raw materials or semi-processed products capable of contaminating the end-product should not come into contact with any end-product unless and until they discard all protective clothing worn during the handling of the material at earlier stages of the processing and have

changed into clean protective clothing. Hands should be washed and disinfected thoroughly before handling products at different stages of processing.

4.6.2.4 Physical and chemical contamination

Appropriate machines should be used to remove physical hazards such as pebbles or heavier stones. Sieves of different diameters may be used to obtain the size required for each product and to remove foreign matter.

Regardless of the type of separator used, the following parameters should be considered: size of particles, density, weight and size, air speed, inclination of the sieve plate, vibration, etc. for the highest effectiveness of the procedure.

Magnets/metal detectors should be used to detect and separate metal from non-metal/metallic matter. For good extraction, magnets should be as close as possible to the metals to be extracted. Magnets work more efficiently when product flows freely. If needed, more than one magnet should be placed in the line. Magnets should be cleaned frequently. Equipment should be designed in such a way as to prevent metals extracted by magnets from being swept by the flow of product. Herbal medicines and related products should be arranged in a fine layer to facilitate this operation.

In all cases, particles identified by the metal detector should be removed and records kept of how much and what type of foreign matter was collected and when it was cleaned. This data should be used in determining how the metals or foreign matter got there in order to implement appropriate corrective measures.

4.6.3 Incoming material requirements

Raw materials or their source plants should not be accepted by the establishment if they are known to contain contaminants which will not be reduced to acceptable levels by normal processing procedures, sorting or preparation. Precautions should be taken to minimize the potential for contamination of the establishment and other products from incoming materials that may be contaminated. Plants, parts of plants suspected of being contaminated with animal or human faecal material should be rejected for human consumption. Special precautions should be taken to reject raw materials showing signs of pest damage or mould growth because of the potential for them to contain mycotoxins such as aflatoxins.

Raw materials should be inspected and sorted prior to processing (foreign matter, odour and appearance, visible mould contamination). Laboratory tests, e.g. for moulds or pathogens such as Salmonella, should be conducted when necessary.

An approved supplier is one that can provide a high degree of assurance that appropriate controls in accordance with this guideline have been implemented to minimize the possibility that chemical, physical and microbiological contamination occurs in the ingredient. Because of the diversity of production practices for herbal medicines and related products, it is important to understand the controls in place for production of the incoming material. When the control measures used to produce the unfinished product are not known, verification activities such as inspection and testing should be increased.

4.6.4 Packaging

Non-porous bags/containers should be used to protect the raw materials or unfinished product from contamination and the introduction of moisture, insects and rodents. In particular, the reabsorption of ambient moisture in humid situations should be prevented. Contamination should be prevented by the use of liners where appropriate. It is recommended that new bags or containers be used for contact packaging. If reusable containers are used, they should be properly cleaned and disinfected before use. All bags/containers should be in good condition and particular attention paid to the potential for loose bag fibers that can become potential contaminants. Secondary containment bags/containers providing additional protection can

be reused but should not have been previously used to hold non-food materials such as chemicals or animal feed.

Dried raw materials or unfinished product should not be sprayed with water during packing. This may result in growth of moulds and microbial pathogens, if present.

Finished products may be packed in air tight containers in order to retard possible mould growth.

4.6.5 Water

The presence of water in the raw material/unfinished product processing environment, even in very small amounts for short, sporadic time periods, may allow microorganisms, including mycotoxin-producing moulds and pathogens such as Salmonella, to grow in the environment. At times, moisture is obvious in the form of water droplets or puddles; or it may be from sporadic sources such as roof leaks. Other sources of moisture may be less visually apparent, including high relative humidity or moisture accumulating inside of equipment. Care should be taken to identify and eliminate such sources of water in the environment to prevent the

development of harbourage sites that can become a source of product contamination.

4.6.6 Documentation and records

Where practicable, a written safety control plan that includes a description of each of the hazards identified in the hazard analysis process, as well as the control measures that will be implemented to address each hazard, should be prepared by the manufacturer or processor. The description should include, but is not limited to, the following: an evaluation of the production site, water and distribution system, manure use and composting procedures, personnel illness, reporting policy, sanitation procedures and training programs.

The following are examples of the types of records that should be retained:

Microbiological testing results and trends analysis

Water monitoring and test results

Manure composting records

Records of plant protection products used (e.g. pesticides, fungicides, herbicides)

Employee training records

Pest control records

Cleaning and sanitation reports

Equipment monitoring and maintenance records (e.g. calibration)

Inspection/audit records

4.6.7 Traceability/Product tracing and Recall procedures

Records should identify the source (or lot number) of incoming raw materials and link the source or lot to the lots of outgoing products to facilitate traceability/product tracing.

4.7 ESTABLISHMENT: MAINTENANCE AND SANITATION

4.7.1 Maintenance and cleaning

Dust accumulation from product in establishments should be removed in a timely fashion through routine housekeeping. This is particularly important for products that are hygroscopic or in environments of high humidity leading to moisture absorption and localized condensation.

4.7.2 Cleaning programmes

A cleaning and disinfection schedule should be established to ensure that all areas of the establishment are appropriately cleaned and that special

attention is given to critical areas including equipment and materials. The air handling system should be included in the cleaning and disinfection schedule. The cleaning and disinfection schedule should describe whether to use wet or dry cleaning. The presence of water in the dry processing environment can result from improper use of water during cleaning.

Dry cleaning is the preferred means of cleaning establishments handling dried raw materials or unfinished products, since the use of water can enhance the probability of contamination from pathogens such as Salmonella. Dry cleaning should collect, remove and dispose of residues without redistributing them or cross contaminating the environment. Dry cleaning involves the use of tools such as vacuum cleaners, brooms, and brushes. Brooms, brushes and vacuum cleaners should be dedicated to specific areas to minimize cross-contamination. By dedicating individual vacuum cleaners to specific areas, vacuumed material can be tested as part of an environmental monitoring program.

Compressed air should generally not be used for dry cleaning except in special situations (e.g. to dislodge dust from inaccessible points). Moreover, if and when compressed air is used, it should be dried and filtered to exclude microorganisms and moisture prior to use.

Dry cleaning is especially important in older establishments in which, in spite of regular maintenance, there may be a potential for the presence of cracks or other harbourage sites that may be difficult to eliminate.

Wet cleaning may be appropriate in certain circumstances. When water usage is necessary, minimal amounts should be used. When wet cleaning is used, it should be followed by disinfection to inactivate microorganisms. Disinfectants that will rapidly evaporate after contact, such as alcohol-based disinfectants, provide a means to spot-disinfect equipment with a very minimal introduction of water. Wet cleaning and disinfection should be followed by thorough drying in order to keep the environment of the establishment as dry as possible.

4.7.3 Pest control systems

Drains should be trapped or otherwise equipped with appropriate means to prevent entry of pests from drainage systems.

4.7.4 Waste management

Suitable provision must be made for the storage and removal of waste. Storage areas for waste should be kept clean. Care should be taken to prevent access to waste by pests.

4.7.5 Monitoring effectiveness

Verification of sanitation should include an environmental monitoring program that has been designed to identify pathogens such as Salmonella in the processing areas. Environmental monitoring should be conducted under normal operating conditions and will usually involve non-product contact surfaces.

Product contact surface testing may be done, particularly as part of corrective actions for an environmental positive. Testing of the raw materials or finished products may also be conducted based on the results of environmental monitoring. Corrective actions should be taken when the microbiological criterion for the test organism is exceeded in an environmental monitoring or finished product sample.

4.8 TRANSPORTATION

Bulk transport of herbal products, should be well ventilated with dry air to prevent moisture condensation, e.g. resulting from respiration and when the vehicle moves from a warmer to a cooler region or from day to night. Prior to bulk transport, the products must be dried to a safe moisture level to prevent germination and growth of mould spores.

4.8.1 General Requirements for Transportation

Raw materials/finished products should be stored and transported under conditions that maintain the integrity of the container and the product within it. Vehicles should be clean, dry, and free from infestation. They should be loaded, transported, and unloaded in a manner that protects them from any damage or water. In warm, humid weather, the products should be allowed to reach ambient temperature before exposure to external conditions

4.9 TRAINING

4.9.1 Training Programmes

A training program should be established to educate employees on the potential sources of contamination during production, harvesting, processing, transportation and storage. Training should address proper hygienic practices to follow in order to minimize the entry or spread of pathogens such as Salmonella spp. Such training should include personnel who enter areas on a temporary basis (e.g. maintenance workers)

5.0 GLOSSARY

This guideline is a recommendation to which manufacturers of herbal medicines and related products should adhere as far as possible, while ensuring the safety of their products in all circumstances. Flexibility in the

application of certain requirements of the primary production can be exercised, where necessary, provided that the product will be subjected to control measures sufficient to obtain a safe product.

Herbal Medicines and related products refers to all natural plant substances such as seeds, berries, roots, leaves, bark, rhizomes, flowers, fruit bodies or other parts presented as herbs, herbal materials, herbal preparations and finished herbal products.. This term equally applies to whole, broken, ground and blended forms.

Disinfest refers to the process of eliminating harmful, threatening, or obnoxious pests, e.g. vermin

Microbial Reduction Treatment refers to the process applied to raw materials in order to eliminate or reduce microbial contaminants to an acceptable level.

Source Plant refers to plant (non-dried) from which the raw material is derived.

6.0 REFERENCES

1. Code of Hygienic Practice for Spices And Dried Aromatic Herbs, Cac/Rcp 42 – 1995, Adopted 1994. Revision 2014. Codex Alimentarius, International Standard Organization
2. Guidelines For Production Inspection Of Herbal Medicines And Nutraceuticals Manufacturing Facilities, National Agency for Food & Drug Administration & Control (NAFDAC) Drug Evaluation & Research (DER) Directorate, 1st June 2020
3. WHO guidelines on good herbal processing practices for herbal medicines, WHO Expert Committee on Specifications for Pharmaceutical Preparations, 52nd Report.

7.0 ANNEX - none

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