

# Environmental control at halal certified food manufacturers

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Contact plates of animal origin are often used by manufacturers to take environmental control samples. But how can testing be performed at halal certified production facilities? Are there any halal compliant alternatives?

## Halal food

Halal is a term related to food and drinks and means "lawful" for consumption by Muslims. Prohibited items are "haram", meaning "prohibited". Halal food laws are mandatory for Muslims. To protect the integrity of halal products, governments have developed strategies and laws to set up halal assurance systems.<sup>2</sup>

Halal Assurance System (HAS) guidelines, for example those of The Assessment Institute for Foods, Drugs and Cosmetics Indonesian Council of Ulama (LPPOM MUI) in Indonesia, are published to support and give guidance to companies on how to implement systems that ensure foods are halal.<sup>1</sup> The LPPOM MUI's "General Guidelines of Halal Assurance System" include strategies to help identify haram critical points and to set up a halal management system at the company, covering qualification, tasks and responsibilities of the members. In addition, they give technical references (e.g. Purchasing Department, OC) and examples of an audit system. In Indonesia, manufacturers need to have a

MUI halal certificate to be able to assure consumers that the food products they make are halal.

Appendix 5 of the above-mentioned guideline lists microbial test products (called microbial products in the guideline) and explains what is considered halal and what haram. For instance, section F5 (Microbial Product) states: "Status of microbial product could be haram if it belongs to the following categories: (...) ii (...) containing haram materials such as blood, peptone from haram source or produce by using enzyme from haram source. iii. Microbial products using enzymes of haram materials in their production process." Section F3 (Vegetable Products) furthermore states that "Materials derived from vegetable are basically halal but if processed with additives and/or processing aids those are not halal, they become not halal. Therefore, it is necessary to know the production process, the additives, and the processing aid used in the making of vegetable products."

## Nutrients for microbiological growth

Microorganisms need nutrients, a source of energy, and certain environmental conditions in order to grow and reproduce. Suitable habitats in the natural environment offer microbes everything they need for growth. To mimic these conditions in the laboratory, culture media are used. These are basically aqueous solutions to which all the necessary nutrients have been added. Complex media are rich in nutrients as they contain water-soluble extracts of plant or animal tissue (e.g., enzymatically digested animal proteins such as peptone and tryptone). Usually a sugar, often glucose, is added to serve as the main carbon and energy source. The combination of extracts and sugar creates a medium which is rich in minerals and organic nutrients.

For microorganism detection in food chain environments, ISO 18593 describes sampling methods and gives recommendations on locations and sampling areas.<sup>3</sup> Manufacturers often use contact plates, selecting the media for detecting the microorganisms of concern according to the respective ISO or other standards. The specific ISO standards contain ingredient lists for preparing the media. For contact plates, nonselective media are mostly used: Tryptic Soy Agar (TSA) for the detection, quantification, and enumeration of heterotrophic bacteria or Sabouraud Glucose Agar (SDA) for yeasts and molds. Such media typically contain animal-derived peptones.

## Environmental sampling in halal certified production facilities

One concern in sampling is the possibility of contamination with haram and najis materials. Najis means unclean in Islamic teaching. When a production facility is contaminated with najis materials, it becomes unsuitable for halal production processes. However, there are three level of najis; heavy, medium, and light. An example of heavy najis is contamination with porcine derivatives (including enzymes extracted from pork). It is forbidden to use media containing pork components in a facility for halal production. Examples of medium najis are blood, alcoholic beverages, and ingredients of animals that have not been slaughtered in a way to make them halal. These products can be used in a halal facility, if followed by cleaning action, with water or a cleaning agent, until the color, smell, and taste are removed.

Environmental monitoring introduces a microbiological level and includes tests using contact plates. Plates with ingredients of animal origin often cannot be used

at a halal certified production line if not made from halal certified ingredients. Contact plates produced with vegetable ingredients are also unacceptable if, for example, they include soya which has been fermented using enzymes from a haram source (see section above).

During sampling, the agar plate surface inevitably comes directly into contact with the production line and therefore enters the halal certified area. However, vegetable or non-animal origin sampling media can be used if they are completely haram source free.

As described above, sampling is allowed only if cross-contamination between haram sources and the halal area can be ruled out with certainty. So, a suitable environmental control system must be able to reliably detect pathogens and in-house strains while simultaneously guaranteeing that the food and the production line remain halal.

### Which alternative methods exist for environmental monitoring?

Halal-compliant contact plates, dip slides, and other products for environmental monitoring are not widely available. However, as an alternative to contact plate sampling, ISO 18593 describes a moistened stick swab technique that avoids having to use non-halal products in food and beverage production. As the diluent, quarter-strength Ringer's solution is suggested, and ISO 6887-5 specifies its ingredients.<sup>4</sup> It contains only inorganic chemicals such as sodium chloride (NaCl), potassium chloride (KCl), calcium chloride anhydrous (CaCl<sub>2</sub>), and sodium hydrogen carbonate (NaHCO<sub>3</sub>). The ingredients are all haram source free, making Ringer solution a suitable choice for a halal certified manufacturer.

Quarter-strength Ringer's solution (Cat. No. 1.15525.0001) is isotonic for bacteria and thus does not subject them to an osmotic shock or damage them osmotically when being removed from their customary environment. It is also physiologically better suitable for sensitive microorganisms than physiological saline.

After sampling, the swab should be transported to the quality control department as quickly as possible, where the swabbed samples are streaked out on appropriate agar plates to detect and enumerate the target microorganisms, e.g. on TSA for the Total Viable Count. If the QC department is spatially separate from the

halal food production area, it is permitted to use growth promoting media made of animal origin ingredients there, with no risk of the products becoming haram.

Section 9 of ISO 18593 lists recommendations for the microbiological analysis. Swabs should be covered with 9 mL to 10 mL of diluent, and this represents the initial suspension for the enumeration of microorganisms. If additional dilution series are needed to determine the microorganism it is recommended to follow ISO 6887.<sup>5</sup> Which part of ISO 6887 to follow depends on the food chain environment.

Furthermore, for detecting microorganisms, section 9 of ISO 18593 stipulates "After the pre-enrichment, follow the instructions according to the microorganism(s) sought." These instructions can be found in the appropriate international standards.

An example of microorganism enumeration after using the moistened swabs is the pour plate technique according to ISO 4833-1. It states "This part of ISO 4833 specifies a horizontal method for enumeration of microorganisms that are able to grow and form colonies in solid medium after aerobic incubation at 30 °C. The method is applicable to (...) b) environmental samples in the area of food and feed production and handling."<sup>6</sup>

Typical environmental monitoring test parameters are:

Parameter	Relevant ISO Standard	Relevant Culture Media
Total viable count	ISO 4833-1	Plate Count Agar
Yeast & molds	ISO 21527 <sup>(7)</sup>	DRBC Agar
<i>Enterobacteriaceae</i>	ISO 21528 <sup>(8)</sup>	VRBD/VRBG Agar
<i>Escherichia coli</i>	ISO 7251 <sup>(9)</sup>	Lauryl sulfate broth (MPN technique)) + EC broth
Coliforms	ISO 4832 <sup>(10)</sup>	VRB/VRBL Agar

**Table 1.** Available alternative culture media that fully comply with ISO Standards

## Conclusion

To set up an effective environmental monitoring system for halal certified food manufacturing that avoids any cross contamination of the food production line with non-halal material, information is needed from the suppliers of microbiological media about the ingredients. For instance, full information regarding the use of enzymes for soy fermentation in the production of soy peptone is necessary. It is not sufficient if the product is designated "vegetable", "animal-free" or something similarly inexplicit.

A system to detect pathogenic or spoilage organisms in accordance with halal guidance needs careful planning of the entire procedure and of the consumables used for environmental control. An option is to use swabs with Ringer's solution for swabbing the various control areas, while detection and enumeration are performed at a separate QC department using animal-origin culture media that include the nutrients for optimal microorganism growth. This way, cross-contamination is prevented.

## Literature and further readings

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(1) THE ASSESSMENT INSTITUTE FOR FOODS, DRUGS AND COSMETICS INDONESIAN COUNCIL OF ULAMA (LPPOM MUI) <https://www.halalmui.org/mui14/>

(2) Anis Najiha Ahmad, Ungku Fatimah Ungku Zainal Abidin, Mohhidin Othman, Russly Abdul Rahman (2018); Overview of the halal food control system in Malaysia

(3) ISO 18593:2018 Microbiology of the food chain — Horizontal methods for surface sampling

(4) ISO 6887-5:2020 Microbiology of the food chain — Preparation of test samples, initial suspension and decimal dilutions for microbiological examination — Part 5: Specific rules for the preparation of milk and milk products

(5) ISO 6887-1:2017 Microbiology of the food chain — Preparation of test samples, initial suspension and decimal dilutions for microbiological examination — Part 1: General rules for the preparation of the initial suspension and decimal dilutions

(6) ISO 4833-1:2013 Microbiology of the food chain - Horizontal method for the enumeration of microorganisms - Part1: colony count at 30°C by pour plate technique.

(7) ISO 21527:2008 Microbiology of the food chain - Horizontal method for the enumeration of yeasts and moulds.

(8) ISO 21528-2:2017 Microbiology of the food chain — Horizontal method for the detection and enumeration of *Enterobacteriaceae*. Part 2: Colony-count technique.

(9) ISO 7251:2005 Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of presumptive *Escherichia coli* — Most probable number technique.

(10) ISO 4832:2006 Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coliforms — Colony-count technique

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