PERTANIKA JOURNALS

SCIENCE & TECHNOLOGY

Journal homepage: http://www.pertanika.upm.edu.my/

Review Article

A Review of Cosmetic and Personal Care Products: *Halal* Perspective and Detection of Ingredient

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ABSTRACT

The term *halal* refers to what ispermitted by Islamic law. It is a basic need for Muslims and encompasses all materials used in everyday life including cosmetics.Muslims want to be assured that the ingredients,handling, processing, distribution, transportation and types of cosmetic used are *halal* compliant. The *halal* aspects of cosmetic and personal care products cover ingredients, all the processes involved in production right up to delivery to consumers, safety and product efficacy evaluations. In order to verify *halal* compliance of cosmetic products, a method of detecting *halal* and non-*halal* ingredients is very important and critically needed. *Halal* cosmetic standards, *halal* certification and the *halal* logo can be used as benchmarks for *halal* compliance. In view of the importance of cosmetic and personal care products from the *halal* perspective, this review will cover the *halal* principles, *halal* cosmetic and personal care products, ingredients, standard and certification as well as safety. The development of the process of detecting non-*halal* ingredients and authenticating *halal* ingredients for potential cosmetic applications in recent years are included in this paper.

Keywords: Halal, cosmetic, personal care, detection, certification, safety

INTRODUCTION

Cosmetics and personal care products have been around for a long time. These products are used daily by many people, and their consumption is on the rise every year. The use of these products isconsidered a necessity for personal hygiene,improved attractiveness, skin and hair protection from harmful ultraviolet light and pollutants and slowing

Article history:
Received: 9 May 2011
Accepted: 8 August 2012

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ISSN: 0128-7680

down ofthe ageing process (Mitsui, 1996). Due to advancement in technology, the cosmetic industry is constantly looking for new and effective products that are readily available, cheap and safe.At the same time,information regarding the identity and the source of the ingredients used in cosmetics is not always readily available; therefore verification ofthe authenticity and acceptability of the ingredients may be needed (Lockley & Bardsley, 2000). In most countries, manufacturers choose to use lard as a substitute for oil because lard is cheaper and easily available. The use of pork and lard is aserious matterfrom the perspective of several religions,for instance, Islam and Judaism. Muslims require the products they use to be *halal* while the Jews require them to *bekosher* (Regenstein *et al*., 2003). The concern is the same: they are concerned that the products might contain ingredients that are questionable (Khattak, 2009). *Halal* refers to things or actions permitted by Islamic law for Muslim consumption (Al-Qardawi,1995; DSM, 2008), and its requirements extend to cosmetic and personal care products; naturally, then, Muslims would want to be certain that the cosmetic and personal care products they use are *halal* compliant. At the same time, Muslims and non-Muslims involved in the production and supply of these products need to understand the meaning of *halal* cosmetic and personal care products and the requirements of *halal* laws.

There are an estimated 2 billion Muslims in the world (MITI, 2006; HDC, 2009). In the Middle East, the growth of *halal* cosmetics has increased by 12% annually and the value of cosmetic product sales in the Middle Eastwas estimated at US$2.1 billion in 2007. Meanwhile, in Saudi Arabia, the total sales of cosmetic products reached USD 1.3 billion in 2006 (Kamaruzaman, 2008). *Halal* products including cosmetic products have the potential of being offerednot only to Muslims but to the world at large (Muhammad, 2007). Today there is increasing awareness concerning *halal* cosmetics; consumers buy *halal* cosmetics if the products are available (Kamaruzaman, 2008).

Detection of non-*halal* ingredients to determine the *halal* status of any cosmetic and personal care products is important to safeguard the integrity of the *halal* products and confidence of the consumers. In the last few years, detection methods for non-*halal* ingredients have been developed quite extensively to assist religious authoritiesin verifying *halal* compliance and to detect the presence of non-*halal* ingredients.Several detection techniques such as Fourier transform infrared (FTIR) spectroscopy, comprehensive two dimensional gas chromatography hyphenated with time-of-flight mass spectrometry (GCxGC-TOF-MS) and gas chromatography mass spectrometry (GCMS) have been developed to detect gelatin, alcohol, fats and oils in cosmetic products (Rohman *et al.,* 2009; Norakasha *et al*., 2009; Hashim *et al*., 2009b). The methods developed could be extended to traditional cosmetic and personal care products that require *halal* certification. This review looks at both *halal* cosmetic and personal care products and the available scientific evidence on detecting non-*halal*ingredients.

HALAL PRINCIPLES

According to *Qur'an Surah* 5 *Al-Maaidah* verses 87-88, *halal* is a *Qur'anic* term meaning 'permitted, allowed or lawful' (Din al-Hafiz, 2008). In the same verses, the term *halal* and *thoyyib* ('good') are also included. According to Al-Qardawi (1995), the term *halal* means 'permissible for consumption and used by Muslims whereas *haram* is anything that is unlawful

or forbidden. *Halal* (lawful) and *haram* (unlawful) are clearly shown in Islam to be serious matters. The word *thoyyib* means the object it qualifies must meet the standards of quality, safety and wholesomeness (Che Man *et al*.,2009) as allowed in Islam.It does not only cover the requirements of religion but also sets a strict adherence to quality and hygiene compliance which is in line with good manufacturing practices (GMP) of the cosmetic industry (DSM, 2008; Amat, 2006). While the emphasis of GMP is on the standards of *halal* cosmetic and personal care products, it also extends to *thoyyib*, to produce clean and hygienic items (DSM,2008). *Halal* covers everything from raw material sourcing to distribution of products, right up to delivery to consumers (Che Man and Sazili, 2010). *Halal* is about trust, responsibility, respect and strict compliance (Che Man *et al*., 2007).

HALAL COSMETIC AND PERSONAL CARE PRODUCTS

In the past, many Muslims used cosmetic products without thinking of the need to meet the *halal* requirement. It seems that Muslims and non-Muslims do not fully understand the meaning and requirements of *halal.* They may think *halal* is only about the manner in which animals are slaughtered for consumption by Muslims (Muhammad, 2007). The *halal*-ness of these products is very important as it might affect the worship and prayers of Muslims.There are many interpretations of *halal.* Generally, *halal* from the perspective of the cosmetic industry means the product does not contain porcine by-products and derivatives and alcohol. However, *halal* as a term has a far wider meaning than that in scope and application. The manufacture and sale of cosmetic and personal care products are regulated in certain countries. The United States Food and Drug Administration (USFDA, 2004), the EU Cosmetic Directive (EU, 1976) and the ASEAN Cosmetic Directive (ASEAN, 2008) have laid down certain rulesfor the manufacture, labelling and sale of cosmetic products. The basic requirements of these regulations concern the safety of consumers who use cosmetic products. The requirement for safety also applies to *halal* cosmetics to ensure that the products are indeed not harmful to the user (DSM, 2008).

The Malaysian Standard MS 2200: Part 1: 2008 prescribes practical guidelines for *halal* cosmetics and the personal-care industry on the preparation and handling of *halal* cosmetic products (DSM, 2008). The standard definition for cosmetic and personal care products is given as "any products or preparation intended to be placed in contact with various external parts of the human body (epidermis, hair system, nails, lips and external genital organs) or with the oral cavity to clean, perfume, change their appearance and/or correct body odors and/or protect them or keep them in good condition" (DSM, 2008; NPCB, 2009a). The products are not for treating or preventing diseases in human beings. Cosmetic and personal care products are *halal* if they comply with Islamic law. Besides the products, accessories accompanying them such as brushes, bottles, containers, packaging, mirrors etc. must also comply with Islamic law. Islamic law states that these products must not contain human parts or ingredients derived from human parts or contain animal by-products that are forbidden to Muslim such as from pigs, dogs etc. Only by-products from animals permitted by and slaughtered according to Islamic requirementsare permissible in cosmetic products; examples of these animals are chickens, cows, buffaloes, turkeys, sheep and goats. Therefore, the source of the raw materials is very important in the formulation of *halal* cosmetic products. If genetically-modified organisms

(GMO)are used in the products, the GMO must not contain components forbidden by Islam. The products must be prepared, processed, manufactured or stored and transported in a clean and hygienic condition. The product must not be contaminated with *najs* in any circumstances and condition. *Najs* is religiously-prohibited dirt (Che Man *et al*., 2007) or ritually unclean material. The product must be clean and not harmful to consumers.

Halal products must be recognised as symbols of cleanliness, safety and high quality (Rajikin *et al*., 1997), and this includes substantiation of its claim and performance. It should be recognised as a credible stamp of hygiene and standards (Amat, 2006). Therefore, the *halal* cosmetics can be used and accepted not only by Muslims but non-Muslims too. For non-Muslims, *halal* can become a mark of unquestioned conformance and quality in trade dealings with Muslims.

Halal cosmetic production activities cover all aspects of the process and production of cosmetic products. Production must be carried out under strict hygienic conditions in accordance with good manufacturing practices (GMP)(NPCB, 2009b) and public health legislations (NPCB, 2009a). If the cosmetic and personal care products are not prepared or processed according to *halal* requirements, they are forbidden from being used by Muslims.

All *halal* cosmetic production establishments are confined to *halal* processing only. They are required not to operate non-*halal* cosmetic processing to avoid mandatory ritual cleansing (DSM, 2008). Segregation at every stage is required for *halal* cosmetic products including storing, displaying and selling. All these activities must be labelled with a sign clearly carrying the word '*halal*' to prevent them from being mixed with or contaminated by things deemed non-*halal.*

INGREDIENTS USED IN *HALAL* COSMETICS AND PERSONAL CARE PRODUCTS

Recently, *halal* aspects in the beauty industry have received great attention due to the revelation of the inclusion of *halal* and *haram* ingredients in cosmetic and personal care products. All ingredients, if they are used for *halal* cosmetics must be checked and must conform to *halal* requirements. This is to ascertain the purity, safety, quality and source of the ingredients. According to the standard (DSM, 2008), "the sources of ingredientsof *halal* cosmetic products can include *halal* animals (land and aquatic), plants, microorganism, alcohol, chemicals, soil, and water as long as they are not hazardous and *najs.*" The presence of alcohol, specifically ethanol, in cosmetics is of very great concern among Muslim consumers. According to Malaysian Standard (DSM, 2008), industrial alcohol is permitted. However, sources from alcoholic drinks are prohibited. All land animals are *halal,* except those that are clearly forbidden such as pigs and animals not slaughtered according to Islamic law. Thus, collagen and placenta from these animals are not permitted. Since anything from human origin is not allowed in *halal* practice, thus, human placenta and cysteine from human hair is not permitted in halal cosmetics. All aquatic animals are *halal* as long as they are not poisonous, intoxicating or hazardous to health. Aquatic animals are those that live in water such as fish but animals that live both on land and water such as crocodiles, turtles and frogs are forbidden in Islam. Ingredients and derivatives from plant origins can be used; this is not normally an issue. It

becomes an issue only if the plants are processed in an unhygienic manner or processed together with unlawful (*haram)* ingredients or if it contains *najs* (DSM, 2008). Therefore, the ingredients in cosmetic products must be stated on labels on the package for the information of consumers.

SAFETY ISSUES

Cosmetic and personal care products placed in the market must not cause any damage to human health when applied under normal or reasonably foreseeable conditions of use (EU, 1976; ASEAN, 2008; NPCB, 2009a). This is the standard of safety that cosmetic and personal hygiene products must fulfil. Safety of cosmetic and personal care products is regulated and required by law all over the world. The products are not allowed to be placed in the market unless their safety has been scientifically proven. Cosmetic products consist ofvarious chemical-based and natural-based ingredients. Many of these compounds are for general use and their properties, use and action are well documented. New ingredients must have proper documentation to prove their safety based on scientific evaluation of the ingredients (Wenninger, 1995). Safety is one of the requirements of halal products.The safety requirements also fulfil the *halal* and *thoyyib* requirement under Islamic law (Hashim *et al.,* 2009a). A cosmetic product is *halal* if it is deemed safe (DSM, 2008). Hence, necessary safety assessmentsare required to ensure cosmetic products are safe for use by consumers and service providers such as hairdressers and beauticians. Care should be taken to avoid skin irritation and sensitisation. If the products are applied around the scalp, face and eyes, eye tolerance needs to be addressed as a major component of the safety assessment of cosmetic products. In ensuring the safety of the finished products, chemical, microbiological and toxicity tests are the basic requirements that need to be carried out. For most cosmetic products, a product deemed safe must have a pH value in the range of 5.0-6.5 (Hashim *et al*., 2009a). Skin and hair have a natural pH; therefore choosing products that are too high or too low in pH will affect the skin and hair by either nourishing or irritating it. Skin has an optimal pH of 5.5 which is mildly acidic in nature. Therefore, maintaining the pH of skin in this range is important because it wouldhelp skin stay healthy, fight blemishes, prevent infections andirritation as well as slow down skin ageing (Anonymous, 2012). Examples of skin care products in this pH range are cleansers, moisturisers and colour cosmetics. The pH range of hair is 4.5-5.5; therefore the healthy range of shampoos should be 6.5. Hair care products with a pH higher than 7.5 would cause the hair to be dry and brittle. Cosmetic products must also not cause any allergic reaction to the skin and eyes. The pH level of 5.5-6.5 is the safest level and will not cause skin and eye irritation. The pH levels below than 3.5 and higher than 9 would cause much irritation to the skin and eyes and should be avoided. As such, the *in vitro* skin and eye irritancy test conducted on these products should be non-irritant to mild-irritant (OECD, 2002; Hashim *et al.,* 2009a). The tested results as mild irritant can be accepted as an indicator of a preliminary irritancy testing and used as a screening tool only. Further evaluation and reconfirmation need to be carried out on human subjects (*in vivo*). If the product tests as irritant, itis not released for sale as it is not safe for users (NPCB, 2009a). According to the Guidelines for Control of Cosmetic Products in Malaysia 2009, cosmetic products are safe if they comply with the toxic metals and total microbial allowable limits (NPCB, 2009a). Hence, the toxic metals in cosmetic products such as lead, arsenic and mercury shall be below 20,

1 and 5 ppm respectively; and the total microbial count is less than 1000 cfu ml^{-1} or cfu g^{-1} (NPCB, 2009a). Careful selection of ingredients is important to make sure that the finished products are safe at a given concentration. Stability of the products might affect their safety; hence, shelf-life study and a challenge test for the preservative effectiveness must be tests that are frequently conducted.

HALAL COSMETICS STANDARDS, CERTIFICATION AND REGULATION

In Malaysia, cosmetic products have to comply with local regulations and meet local quality control requirements (NPCB, 2009a; Hashim *et al*., 2009b).To get *halal* certification from the Department of Islamic Development Malaysia (JAKIM), products must fulfil the requirements of Malaysian Standard MS 2200:2008 (DSM, 2008) and *Halal* Certification Procedure Manual which require strict factory inspection and audit (JAKIM, 1993). The certification ensures that *halal* cosmetics are of high-quality and are ethical products i.e. products that are compliant with Islamic law, keep within the parameters designed for health and safety and benefits of users regardless of age, faith or culture.Consumers should look for the *halal* logo/mark that certifies the product as *halal* compliant. The certification body responsible for granting the *halal*logo (Fig. 1) in Malaysia is JAKIM.The *halal*label issued by JAKIM is a registered trademark under the Trade Mark Act 1975. Besides JAKIM, there are other certification bodies worldwide that certify and award the *halal* logo. However, these *halal* certification bodiesvary in their set-up inimplementing, inspecting, awarding and monitoring *halal* certification.

Fig.1: Malaysian *halal* logo

NON-*HALAL* INGREDIENT DETECTION

Detection of the ingredient authenticity in *halal* cosmetic products is important to determine that the products, especially the oils, fats, and proteins, are *halal* compliant. Muslim consumers are concerned about the mixing of animal fats, especially any form of lard in food, cosmetics and pharmaceutical products; indeed, this is a cause of great concern not only to Muslims but followers of several other religions, for instance, Judaism (Marikkar *et al*., 2002). *Halal* cosmetic products must not contain or be contaminated with porcine-derived products. Therefore, the detection of adulteration due to one or more of the ingredients is a very important criterion in *halal* verification.

Cosmetic products are complex and contain several components of highly processed products. These highly processed products are manufactured from ingredients of animal or plant origins, which undergo various and usually multiple treatments either chemical or physical, commercially processed, and used as ingredients in the cosmetic, food and other industries (CFIA, 2008). Examples of the products are amino acids, collagen, sorbitol, albumin, fatty acids and enzymes. As such, cosmetic analysis has become quite difficult due to the usually high complexity ofingredient usage.

Detection of *halal/haram* sources from raw materials and intermediate ingredients in these cosmetic products may be determined using several latest techniques of various state-of-the-art instruments. It is a critical aspect of ensuring ingredients as well as the final products are *halal*. Analysis of adulteration of oil and fats with cheaper oil-like animal fats has become attractive and common in recent years. Virgin coconut oil (VCO), for instance, is an excellent material to be used as a softener and skin moisturiser due to its effectiveness and safe mineral oil with no allergic reactions (Agero & Verallo-Rowell, 2004). If VCO has been adulterated with lard in cosmetic cream formulations, this adulteration can be detected using Fourier transform infrared (FTIR) spectroscopy in combination with attenuated total reflectance (ATR) (Rohman *et al.,* 2009). The finger print region of 962 and 721 cm^{-1} was used asa marker to differentiate VCO from other components in the formulation. FTIR spectroscopy with ATR and partial least square (PLS) regression was able to detect the presence of lard in cocoa butter at the frequency region of 4000–650 cm^{-1} (Che Man *et al*., 2005b) and a similar FTIR method with ATR and discriminate analysis (DA) was able to classify cod-liver oil samples from common animal fats (beef, chicken, mutton, and lard) based on their infrared spectra at the selected fingerprint regions of 1,500-1,030 cm^{-1} (Rohman and Che Man, 2009). FTIR is able to differentiate lard in a mixture of animal fats (lamb, cow and chicken) at selected infrared fingerprint range of 1500-900 cm^{-1} (Rohman & Che Man, 2010) and differentiate mixtures of plant oils such as VCO, palm and olive oil in the frequency regions of 1,120-1,105 and 965-960 cm^{-1} (Rohman *et al*., 2010).

Since animals and vegetables are chemically different in their fatty acid composition, the use of fatty acid methyl esters (FAME) profiles could beused as a basis for discriminating lard from other animal fats in the *halal* detection process. Gas chromatography hyphenated with time-of-flight mass spectrometry (GC-TOF-MS) in combination with two different microbore columns (SLB-5ms and DB-wax) may also be used. This method was, in fact, able to detect the differences in animal-derived fats between lard, cattle, chicken and goat in a study by Indrasti *et al.* (2010). The detection allowed the differentiation of lard from other animal fats by three FAMEs constituents involving methyl trans-9,12,15-octadecatrienoate (C18:3 n3t), methyl 11,14,17-eicosatrienoate (C20:3 n3t) and methyl 11,14-eicosadienoate (C20:2 n6). These three FAMEs constituents are not present in other animal and plant fats.

Based on thermal profiles, differential scanning calorimetry (DSC) can be used to detect the presence of lard/chemically randomised lard (CRL) as adulterants in refined, bleached, deodorised (RBD) palm oil (Marikkar *et al*., 2001). The mixture of lard with other common animal fats such as mutton tallow, beef tallow and chicken fat from 0.2 to 20% showed that the lard adulteration peak could be distinctly identified at a detection limit of 1% lard/CRL. Both lard and CRL demonstrated two major exothermic peaks at 4.9 and -16.9ºC and 10.4 and

-16.1ºC respectively. When the lard/CRL adulterated concentration in RBD increased from 1 to 20%, the shoulder peak at -43.9ºC was found to gradually increase in size and shift in peak position towards a higher temperature.

Lard adulterants in refined, bleached, deodorised (RBD) palm olein can be detected using the surface acoustic wave (SAW) sensing electronic nose (zNose) (Che Man *et al*., 2005a). The zNose produced a two-dimensional olfactory image called VaporPrint™. This method was found to be reliable and could be used for rapid detection of 1% lard substances in sample admixtures. The VaporPrint™ demonstrated that the changes in the strength of the volatile compounds showed good correlation with the adulterants in RBD palm olein. The adulterated RBD palm olein with lard was found to produce distinct peaks in the range of 0.7-4.5 s.

Gelatin is common in food, cosmetic and pharmaceutical products as a thickening agent and casing for capsules. It has been used for many years in the cosmetic industry as 'gelatin hydrolysate' and is a source of collagenin topical creams, lipstick and hair care products (Schrieber & Gareis, 2007). Gelatin hydrolysates are important components of skin care products due to their ability to confer firmness, elasticity and moisture to skin, while in hair care products they improve hair gloss and facilitate combing. Gelatin from bovine and porcine by-products or derivatives that are used in food, cosmetic and pharmaceutical products can be detected using FTIR with ATR and discriminant analysis (Hashim *et al*., 2010). Using chemometric and principal component analysis (PCA) it was possible to yield spectra that were able to classify and characterise gelatin compounds using regions of FTIR spectra in the range of 3290–3280 cm^{-1} and 1660–1200 cm^{-1}. The results of a PCA score plot showed that it is possible to distinguish gelatin sources (porcine and bovine) by utilising the main amino acids present in gelatin i.e.glycine, proline and hydroxyproline as potential markers (Norakasha *et al.,* 2009). The amino acid composition of bovine skin gelatin (BSG) and porcine skin gelatin (PSG) can be differentiated by high performance liquid chromatography (HPLC). PSG contains high concentrationsof glycine (239), proline (151) andarginine (111) compared to BSG which has lower amounts of these substances i.e. its glycine (108), proline (63) and arginine (47) (Raja Mohd Hafidz *et al*., 2009). Based on detection and identification of marker peptides in digested gelatins, a new method for differentiation between bovine and porcine gelatin by high performance liquid chromatography/tandem mass spectrometry (HPLC-MS/MS) was developed (Zhang *et al*., 2009). The gelatins were digested by trypsin enzyme, and the peptides were analysed for sequence alignment. The bovine and porcine Type I collagen contained differential sequences. A key factor affecting the peptide identification was found to be proline hydroxylation. Digested bovine and porcine gelatin led to the detection of peptides such as GPPGSAGSPGK and GPPGSAGAPGK respectively.

A method for species identification from pork and lard samples using polymerase chain reaction (PCR) with restriction fragment length polymorphisms (RFLP) analysis of a conserved region in the mitochondrial (mt) cytochrome *b* (cyt *b*) gene has been developed for *halal* detection (Aida *et al*., 2005). In the study, the PCR products from pork and lard digested with restriction enzyme *Bsa*JI were able to generate the expected fragments of 131 and 228 bp. Hence, the standard restriction pattern for pork can be generated by PCR-RFLP. This method is a potentially reliable technique for detection of pig meat and fats from other animals for *halal*

detection. In some countries, the manufacturers choose to use lard as a substitute ingredient for oil because it is cheaper and easily available.

Most Muslim consumers are very concerned about the presence of alcohol (ethanol) in their cosmetic products eventhough the ethanol used is industrial ethanol, which is permissible in Islamic law. Muslim consumers nevertheless still insist on alcohol-free products. In one instance as recorded by Hashim *et al*. (2009a), eleven cosmetic samples were tested including products that were attested to be alcohol-free such as attar perfume; the tests showed that the ethanol content of these products was below 0.06% (600 ppm). Attar perfume is the purest form of perfume oil that does not contain any alcoholic or chemical residues. However, with sensitive equipment, trace amounts of ethanol were detected in the attar perfume sample. The ethanol test was conducted by headspace-GC-MS equipped with DB-624 capillary column in the temperature programme from 50-200ºC with a holding time of 2 min for every 50ºC. The linear concentration range was 1-1000 ppm and the correlation coefficient was relatively good (R^2=0.99270). The method was very sensitive as the limit of detection (LOD) was 7 ppb and limit of quantification (LOQ)was 34 ppb.

CONCLUSION

Halal products are a basic need for all Muslims. *Halal* cosmetic and personal care products cover all aspects of the production process beginning with the raw materials (ingredients) and on from there to encompass handling, processing, storage, distribution, transportation and delivery to the consumer. It also includes the safety of product and product efficacy. In order to verify the *halal* compliance of products, the development of a method of detecting and authenticating non-*halal* ingredients is very important and critically needed. The introduction of the new *halal* standard MS 2200:2008 for cosmetic and personal care products is an aspiration to set world standards to manufacture quality *halal* cosmetic products for consumers. Together with the *halal* certification and the *halal*logo/mark, *halal* standards can serve as a benchmark for *halal* compliance.

ACKNOWLEDGEMENTS

The author thanks Universiti Putra Malaysia (UPM) for its continuous support in completing this manuscript.

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