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Optimizing Mist-Based Ablution: A Comprehensive Study of Water Distribution and Conservation Using Watercolour Visualization and Thermal Imaging Techniques

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Abstract: Conducting ablution constitutes a prerequisite for Muslims prior to engaging in prayer. This ritualistic practice involves the cleansing and wiping of specific body parts, including the hands, face, arms up to the elbows, head, and feet. Ensuring comprehensive water coverage of the aforementioned areas is a crucial criterion during ablution. However, excessive water consumption often occurs when Muslims perform ablution to achieve full coverage. Consequently, a more ecologically sustainable approach to ablution is necessary to minimize water wastage. A proposed water mist spray device aims to optimize water usage while adhering to the Islamic jurisprudence requirements of complete water coverage on ablution parts. To assess water coverage using the mist spray, an evenness distribution profile is employed through atomized mist colorization on paper and thermal imaging of ablution parts. An appropriate spray nozzle is chosen based on an analysis of spray distribution and coverage patterns on the target surface, utilizing image processing techniques. The proposed methodology involves mixing water with red watercolour and manually pumping it through the selected nozzle using an off-the-shelf water sprayer, thereby atomizing the coloured water to stain white paper. Subsequently, the paper is converted into a digital image and analysed using ImageJ software to determine the mist spray coverage percentage, spatial spread at various distances, and the extraction of stain and droplet sizes. This technique is applied to different types and sizes of spray nozzles to identify the most suitable nozzle for the prototype. The findings demonstrate that nozzles with smaller exit holes and higher water pressure yield more extensive spray coverage on the target surface. Upon selecting the appropriate nozzle, a Portable Ablution Mist Spray Device prototype is employed to evaluate water coverage for the ablution body parts. Thermal images of the ablution parts are captured before and after the ritual, with the temperature differences being analysed. The thermal images reveal a comprehensive and uniform spray distribution on the ablution body parts, accompanied by a temperature difference ranging from 0.9°C to 3.8°C among various participants.

Keywords: Ablution, mist spray, nozzle, image processing, thermal imaging, evenness, spray coverage, water-sensitive paper, ImageJ software

1. Introduction

In the Islamic faith, adherents are required to perform ablution before engaging in the five daily obligatory prayers. Ablution, a ritual purification process, necessitates the sequential washing of specific body parts – the face, both arms, head, and both feet – using clean water. This purification act is deemed mandatory prior to prayer; as Islamic jurisprudence maintains that prayers are rendered invalid without proper ablution. Consequently, ensuring the validity of one's ablution is of utmost importance for Muslims.

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A fundamental condition for valid ablution is the thorough distribution and coverage of water across all designated body parts. In practice, Muslims typically utilize between 6 to 9 litres of water from conventional taps for ablution. However, only 2 litres are effectively used for the ritual, with the remaining 4 to 7 litres being wastefully expended [1]. Historically, the Prophet Muhammad is said to have employed merely a Mudd, equivalent to approximately 0.687 litres of water, for ablution [2]. Thus, the contemporary Muslim community must develop an ablution system that significantly reduces water usage while adhering to the principles of Islamic jurisprudence.

Given the objectives of Maqasid Syariah (protection of lineage) and Sustainable Development Goal 6 (accessibility to water), it is imperative to decrease water consumption to ensure a sustainable future for subsequent generations. In light of escalating river pollution in Malaysia and the diminishing availability of safe drinking water sources, safeguarding this vital resource is essential. The primary goal of this research is to devise a portable ablution mist spray device that minimizes water usage during the ritual purification process.

To assess the device's efficacy, thermal imaging techniques will be employed to analyse the spray distribution and confirm the even coverage of water on the relevant body parts. Furthermore, various types of spray nozzles will be evaluated using image processing techniques and the concept of Water-Sensitive Paper to enhance the misting system. Ultimately, this research aims to create an efficient, eco-friendly ablution method consistent with Islamic principles, thereby safeguarding natural resources for future generations.

Mudd is a unit of measurement for volume used by Prophet Muhammad SAW. 1 Mudd is the equivalent of 687 milliliters.

2. Research Background

In 2007, AACE Technologies Sdn Bhd, a Malaysian firm, developed one of the earliest automated ablution machines called the Auto Wudu' Washer (AWW) [3]. Employing an infrared sensor to identify the human body and regulate water flow, this machine aims to reduce water consumption and spillage during ablution. Despite its beneficial functionality, the AWW's high cost, immobility, and substantial water outlet remain drawbacks. Alternatively, Suratkon et al. [4], proposed a solution called SmartWUDHU, which recycles ablution water through university facilities and infrastructure via a re-circulation system. Similarly, Mukhtar et al. [5] designed a portable ablution system using an ergonomic approach that utilizes a dual upper and lower limb ablution mechanism. This system requires users to provide 1.5 litres of bottled water, which flows through the device to facilitate the ablution process. Nonetheless, these efforts do not prioritize reducing water consumption to less than 1 Mudd. As an alternative, fatwas allowed the use of commercially available multipurpose sprayers, provided they meet the necessary ablution criteria [6].

As previously noted, a key prerequisite for valid ablution is ensuring comprehensive water coverage of the requisite body parts. To the authors' knowledge, no studies have been conducted thus far to investigate the uniformity of water distribution by spray or mist systems on ablution areas. Nevertheless, in a closely related context, Oh et al. [7] assessed thermal sensations and comfort for participants exposed to four distinct modes of mist spray, monitoring skin temperature variations in a misting environment.

While numerous studies have explored spray systems in fields such as agriculture [8], painting, fire suppression [9], and sanitation, none have specifically addressed the application of spray or distribution systems to human skin. The traditional method for evaluating spray patterns involves the use of water-sensitive paper as a target surface. This paper features a specially coated yellow surface that changes to dark blue upon contact with moisture. Water-sensitive paper has been employed in the agricultural domain to ascertain spray droplet size and distribution on plants [10], [11], [12], [13]. By positioning the paper on plant leaves during the spraying process, researchers can observe the staining of sprayed particles on the paper surface, which immediately shifts from yellow to blue based on droplet distribution.

In a pertinent study, Wang et al. [8] explored the potential of employing a vision-based sensing approach to detect pesticide spraying droplet deposition in agricultural fields. Their research suggests that digital image processing can effectively analyse pesticide droplet distribution. To facilitate the evaluation of the sprayer, the study utilized a simulated model incorporating Petri dishes containing silicone oil and a red-coloured liquid spray to enhance the visibility of the sprayed droplets during the initial image capture stage [10].

Thermal imaging techniques employ infrared radiation and thermal energy to gather information about objects. This technology allows users to capture the infrared radiation emitted by all objects with an absolute temperature above zero, highlighting areas with higher heat concentration using a differentiated colour spectrum within varying temperature scales [14]. A study conducted by Jiao et al. [15] demonstrated that thermal imaging can be employed to detect thermal differences before and after the spraying process, thereby evaluating pesticide spray drift. Based on this literature, it is conceivable that water-sensitive paper and thermal imaging could be combined to examine water evenness and distribution on ablution parts. As water is sprayed onto the human body's surface, a reduction in the surface area temperature covered by water is anticipated due to water's heat capacity on the surface. The thermal imaging technique can help identify areas covered and not covered by water droplets. A study by Oh et al. [7] revealed that air temperature decreases by 2.9°C ± 1.2°C when a mist system operates in a mist spray environment, causing a skin temperature reduction of -0.53°C.

3. Method

The assessment of spray systems commences with an examination of the conventional sprayers available in the market. Certain varieties of these conventional sprayers have already found applications within the Muslim community for performing ablution under specific circumstances and locations. Evaluating the spray performance in terms of water distribution and coverage allows for the determination of the sprayer's reliability. The analysis conducted in this study aims to elucidate the spray characteristics and behaviour.

It is suggested that an image processing approach, employing ImageJ software, be utilized for conducting the experiment. A prototype of a portable ablution spray device is employed to identify the optimal nozzle size for the misting system. The methodology for selecting the nozzle parallels that of the conventional sprayer evaluation. To assess the prototype's suitability for public use, a thermal imaging evaluation is conducted to verify the uniformity and efficacy of the prototype.

3.1 Evenness Assessment for Conventional Sprayers

In order to evaluate the performance of conventional spray devices, two distinct experimental approaches were employed, focusing on variations in both sprayer type and applied pressure. Experiment 1 involved the selection of three distinct conventional sprayers, designated as A, B, and C, as illustrated in Fig. 1. These sprayers served as independent variables in the investigation of the impact of nozzle design on mist distribution patterns. Sprayer A is a compact device commonly employed for dispensing perfume and hand sanitizer and has been utilized in amenity kits for Hajj pilgrims during ablution rituals. Sprayer B represents a medium-sized device with diverse applications, including the distribution of Febreze air fresheners, plant hydration, hand sanitizer, and household cleaning solutions. Sprayer C is a large-scale device typically used in agricultural settings for plant irrigation and pesticide application, relying on an air pressure compressor to propel water through the nozzle.

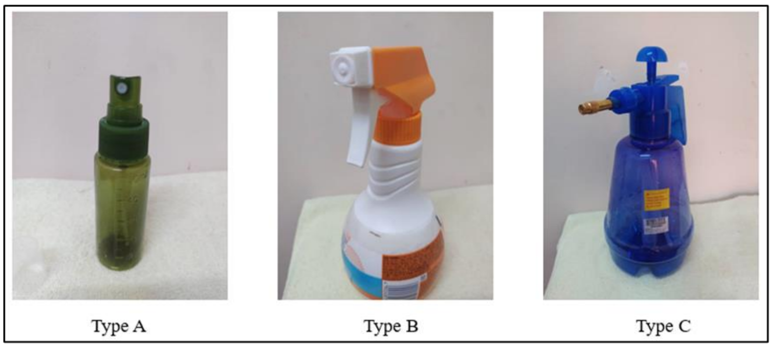


Fig. 1 - Three different types of conventional sprayer used for spray coverage assessment

3.1.1 Experiment 1: Effect of Spray Nozzle to The Mist Distribution

The objective of this investigation is to examine the dispersion of water mist generated by three distinct nozzle designs, as depicted in Fig. 1. This investigation seeks to determine the impact of varying nozzle configurations on mist distribution and identify the optimal design for achieving uniform coverage. To accomplish this, a digital image processing method, specifically utilizing ImageJ software, will be employed to analyse the red coloration visible on a white drawing paper following mist application. Red watercolour serves as a tracer for the water mist, enabling a clear visualization of the distribution pattern. A white drawing paper measuring 7 cm x 7 cm will act as a target surface, simulating human skin. Three spray bottles containing red watercolour will be utilized to generate mist at three distinct horizontal distances: 10 cm, 20 cm, and 30 cm. The staining of the target surface by red droplets will be analysed to evaluate the distribution patterns. Fig. 2 presents examples of spray patterns from nozzles A, B, and C at a distance of 20 cm.

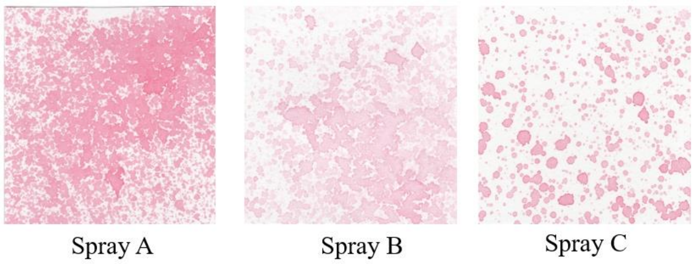
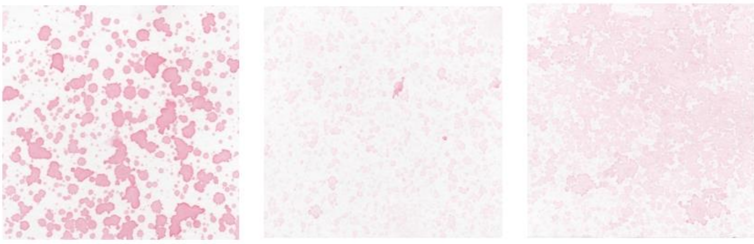


Fig. 2 - Sample of spray pattern from spray A, B and C at distance of 20cm

3.1.2 Experiment Part 2: Effect of Water Pressure to The Mist Distribution

In addition to examining the influence of the nozzle on spray distribution, the water pressure exerted on the sprayer can also impact the mist evaporation in terms of droplet size and quantity generated. Consequently, by employing Sprayer C, varying levels of compressed air pressure were assessed within the sprayer. Three pressure levels - low, medium, and high - were evaluated in this investigation. For each pressure level, identical, red-coloured water was dispersed onto the target surface and subsequently analysed using the same image processing analysis technique. The distance was maintained at 20 cm from the target surface. The pressure level in Sprayer C can be adjusted using the provided manual pump valve to introduce air at the desired pressure into the container. Fig. 3 illustrates the samples of spray patterns from Sprayer C at different pressures. As indicated in Fig. 3, higher pressure results in a more uniform droplet pattern on the paper surface.



Low Pressure Medium Pressure High Pressure

Fig. 3 - Sample of spray pattern from spray C at low, medium, and high pressure

3.1.3 Image Processing Analysis

In order to validate the efficacy of the ablution process, a comprehensive examination of the mist distribution must be conducted. Consequently, following the procurement of spray pattern samples from each experiment, these samples are transformed into digital images utilizing an image scanner from a Canon E410 printer. This facilitates the subsequent image processing analysis with the aid of ImageJ software. ImageJ, a Java-based image processing application developed by the National Institutes of Health, is designed to analyse images containing minuscule particles, such as bacteria observed through a microscope. Fig. 4 presents the graphical user interface of ImageJ.

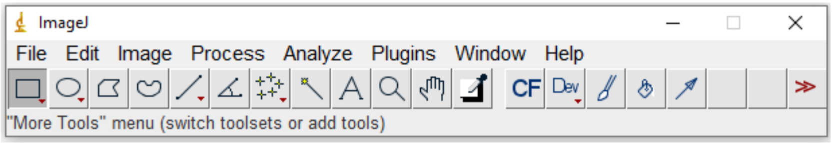


Fig. 4 - ImageJ graphical user interface

The utilization of this method facilitates the measurement of the target surface's area while concurrently enumerating the quantity of diminutive droplets present [16]. The analysis of the selected area can yield multiple outcomes, including the total number of droplets, droplet area, spray distribution, and the percentage of the area occupied by the droplets. To accurately ascertain the actual droplet diameter, equations (1), (2), and (3) may be employed for the conversion of the spot area.

$$d = 0.95\, d_s^{0.910} \quad (1)$$

where,

$$d_s = \sqrt{\frac{4A}{\pi}} \quad (2)$$

A = Spot area acquired from ImageJ

Inserting and re-arranging the given equation, we obtain the precise diameter of the mist droplets as

$$d = 1.06\, A^{0.455} \quad (3)$$

From Equation (3), it is possible to compare the droplet diameters across various spray samples. This analysis enables the determination of conditions under which the spray generates either smaller or larger droplet particles.

Furthermore, the results elucidate which sample yields the maximum percentage of spray coverage, achieving an optimal distribution level. Fig. 5 illustrates an example of image processing analysis utilizing ImageJ software. Subsequently, this procedure can be employed to ascertain whether the mist distribution suffices to meet the criteria for a valid ablution, as mandated by Islamic jurisprudence.

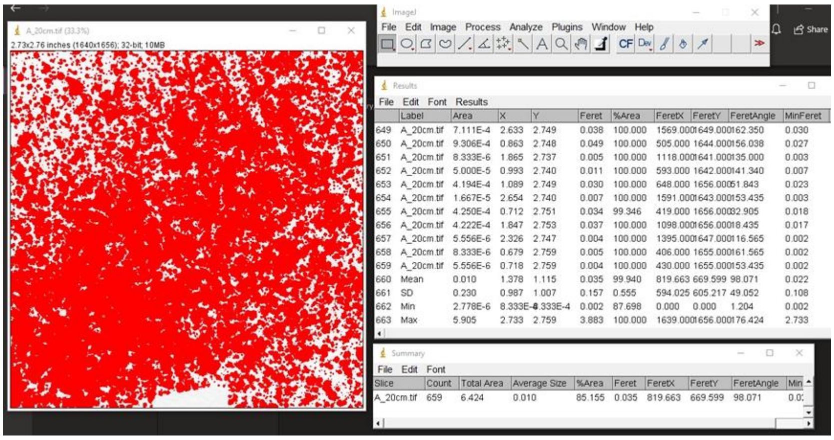


Fig. 5 - Example of image processing analysis using ImageJ software

3.2 The Prototype of Portable Ablution Spray Device

The portable ablution spray device prototype underwent a series of modifications and enhancements from its previous design iteration to optimize its misting system performance. These alterations encompassed various aspects, including the device's structural design, electronic components, mechanical elements, and electrical configuration. Notably, the selection of an appropriate nozzle for the misting system was deemed crucial. The chosen spray nozzle must ensure uniform coverage on the surfaces intended for ablution in order to satisfy the requisite conditions of the ritual purification process.

3.2.1 System Design and Operation

Significant modifications were implemented to the system's structural design and auxiliary components to enhance the device's performance and efficacy. The prototype was reconfigured in terms of dimensions and capacity to facilitate increased water storage. Employing 3D printing technology, the primary structure was constructed, offering superior strength compared to the previously used acrylic sheet. The water reservoir is detachable from the primary structure, enabling effortless refilling. The container holds a maximum water capacity of 750 millilitres. Fig. 6 displays the updated prototype of the portable ablution spray apparatus.

Fig. 6 - Prototype of portable ablution spray device

The water was propelled through the spray nozzle utilizing a 5 V DC water pump motor within the system. This system employs an Arduino Nano as the primary microcontroller. Energy is supplied to the system by a pair of 3.7 V rechargeable lithium-ion batteries. The prototype's functionality is based on an ultrasonic sensor's object detection, which serves as an input. Upon recognizing body parts, the sensor transmits signals to the Arduino Nano for water atomization. When the distance between the sensor and the body part is less than 10 cm, the Arduino activates the water pump unit's motor, causing water to flow towards the mist spray nozzle for atomization, thereby facilitating ablution. However, if the distance exceeds 10 cm, the motor remains inactive. Accurate distance detection is crucial for ensuring adequate mist distribution to individuals performing ablution while simultaneously activating the spray only when necessary, thereby conserving water resources.

3.2.2 Experiment 3: Nozzle Selection

In this study, a range of brass fog mist nozzles with varying diameters was employed for experimentation purposes. An optimal nozzle was identified by examining the spray patterns generated by commercially available brass nozzles with diameters of 0.2 mm, 0.3 mm, 0.4 mm, 0.5 mm, and 0.6 mm. The evenness assessment methodology utilized in Experiments 1 and 2 was implemented to ascertain the most efficacious nozzle size for ablution purposes. Each nozzle size underwent three experimental repetitions to obtain an average coverage percentage. The nozzle yielding the highest spray coverage percentage was chosen as the primary nozzle for the prototype. Fig. 7 illustrates sample spray patterns originating from the various nozzle sizes. Experimental results indicated that the 0.6 mm nozzle was the most suitable for ablution and was subsequently employed for verification and validation processes.

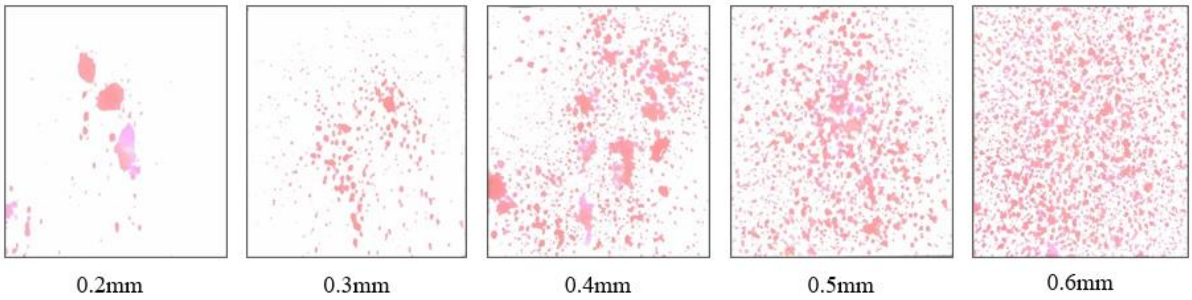


Fig. 7 - Sample of spray pattern for different sizes of nozzle from 0.2mm to 0.6mm

3.3 Thermal Imaging Validation

A FLIR C3 thermal imaging camera was employed to ascertain the uniformity of water coverage on the body during the ablution process. Thermal imaging provides a visual representation of the infrared radiation emitted by the object under observation and its surroundings [17]. This method enables the display of the spray coverage area on the body parts intended for ablution. Infrared thermal imaging technology facilitated the identification of thermal radiation differences between spray droplets and the surrounding environment, leading to a vivid image showcasing the droplets' range and concentration distribution [15].

Six individuals were selected as volunteers to test the prototype. Each participant was required to perform ablution using the prototype device. A thermal imaging camera captured images of the ablution body parts (e.g., hands, elbows, and face) before and after the process. The pre- and post-ablution temperatures of these body parts were compared to verify the uniform distribution of water on the body surface. It was anticipated that the temperature after performing ablution would be lower than before due to the water mist distributed on the surface of the ablution body parts, an effect analogous to the cooling properties of perspiration. The thermal images were analysed using FLIR Tools software. Fig. 8 presents a sample of thermal images from a volunteer before and after performing ablution. The temperature gradient in the images demonstrates a significant reduction in surface temperature, indicating comprehensive water distribution on the face.

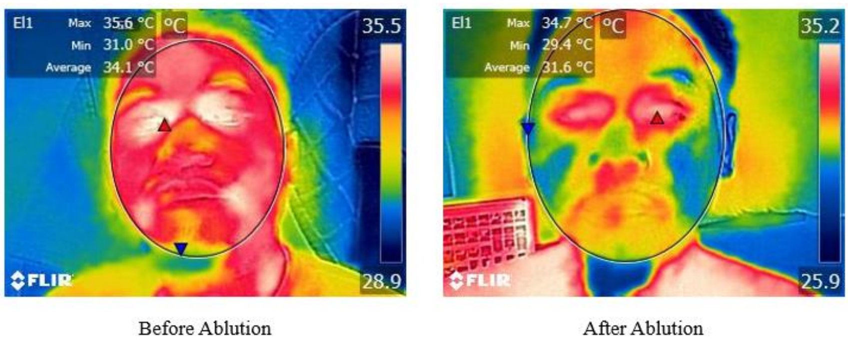


Fig. 8 - Sample of thermal image from the volunteer before and after the ablution

4. Results and Discussion

As demonstrated in Table 1, the findings indicate that Spray A and B yield extensive coverage across multiple distances, whereas Spray C exhibits the least coverage at all three distances tested. This disparity can be attributed to the smaller exit apertures and elevated air pressure present in the nozzles of Spray A and B compared to Spray C. The reduced exit aperture size enhances water atomization, resulting in a higher quantity of droplets with smaller particle dimensions. The droplet sizes generated by Spray A and B are significantly smaller than those produced by Spray C, and the spacing between droplets is also diminished. This leads to increased coverage on the target surface. Consequently, it is recommended that Spray A and B be employed as water mist spray systems for the ablution spray device, as they can deliver the desired water distribution during the ablution process.

Table 1 - Spray coverage and droplets assessment from different type of conventional sprayer

Sprayer	Distance (cm)	Coverage (%)	Droplets Counted	Mean Area for 1 Droplet (μm^2)	Actual Diameter of Droplet, d (μm)
A	10	93.68	460	0.08	0.34
	20	85.16	659	0.26	0.57
	30	81.19	6161	0.25	0.56
B	10	96.77	429	0.26	0.57
	20	71.30	4087	0.27	0.58
	30	84.07	3292	0.53	0.79
C	10	41.35	2234	1.59	1.31
	20	25.53	1731	2.64	1.65
	30	27.87	1223	7.94	2.72

In addition to the nozzle type, the water pressure at the nozzle exit significantly influences the spray distribution. As evidenced in Table 2, increased water pressure results in greater spray coverage and finer mist particles. This observation aligns with previous research findings on the pressure's impact on spray characteristics, such as those reported in [18] and [19]. It is crucial to emphasize that, for a mist ablution device, considering water pressure during the design phase is essential to ensure uniform water distribution, thereby facilitating valid ablution processes.

Table 2 - Spray coverage and droplets assessment based on pressure applied

Pressure	Coverage (%)	Droplets Counted	Mean Area for 1 Droplet (μm^2)	Actual Diameter of Droplet, d (μm)
Low	38.62	2354	1.32	1.2
Medium	62.55	14206	0.08	0.34
High	80.28	3085	0.05	0.27

As the dimensions of the nozzle aperture substantially influence the spray pattern and coverage on the intended surface, it is imperative to select an appropriate nozzle that yields the desired spray pattern and coverage, ensuring uniform water distribution on the designated ablution body parts. Based on the data presented in Fig. 9, the spray pattern generated by a 0.2 mm nozzle size exhibits minimal water distribution on the target surface, rendering it unsuitable for use as a spray nozzle due to its inability to achieve uniform coverage on the ablution body parts. Conversely, a nozzle size of 0.6 mm delivers the most extensive spray coverage when compared to other sizes. Consequently, this nozzle size is the optimal choice for the prototype to be incorporated into the ablution device. In this context, it is crucial for designers of mist spray systems to consider the various nozzle sizes, as the size of the nozzle will directly impact the water distribution on the ablution body parts, ultimately determining the validity of the ablution itself.

A thermal imaging assessment was executed to ascertain the efficacy of the prototype spraying system. An example of the thermal imaging results obtained from a volunteer can be observed in Fig. 8. Thermal images are composed of pixels, with each pixel representing a unique temperature data point. These data points are assigned a distinct colour or shade based on their value, enabling the determination of whether a location has been covered with water. Due to the cooling effect of water, the temperature in areas where water is distributed on the surface is lower than in those without. A spot measurement, as depicted in Fig. 10, was conducted across a human face to gauge temperature variations across the facial surface and calculate the average temperature. The face was selected as the body part for this validation experiment, as it is one of the mandatory body parts in ablution. The facial area was specifically isolated using FLIR tools to eliminate extraneous temperature measurements from other areas, such as the background and body.

The data obtained from the thermal image spot measurements is presented in Table 3. Upon examining Table 3, it is evident that the average temperature experiences a reduction of approximately 2°C, which signifies the device's capability to provide a uniform distribution. Nonetheless, varying degrees of temperature difference, ranging from 3.8°C to 0.9°C, were observed among different individuals. This variation may be attributed to innate differences in body metabolism and subtle disparities in the ablution techniques employed. Despite these differences, all subjects exhibited a decrease in average facial surface temperature following the mist ablution process. This observation implies that the device is suitable for ablution purposes, even in the presence of minor variations in technique. Furthermore, as a point of comparison, the maximum and minimum temperature values on the facial area before and after ablution were also evaluated. These fluctuations can be ascribed to the location of spot measurements, as distinct facial surfaces and contours emit varying levels of heat.

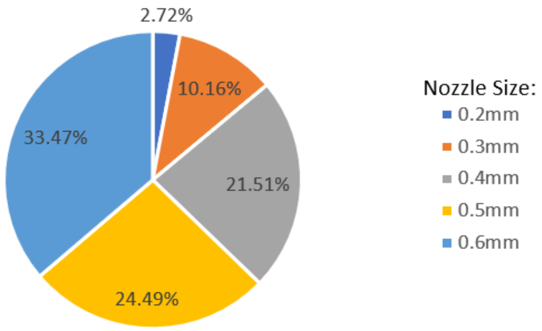


Fig. 9 - Correlation between spray coverage and nozzle size

Fig. 10 - Region of interest with spot measurement

Table 3 - Temperature value from thermal imaging sample

Person	Temperature (°C)					
	Before Ablution			After Ablution		
	Max	Min	Average	Max	Min	Average
1	36.8	31.9	35.3	34.1	29.1	31.5
2	35.6	31.0	34.1	34.7	29.4	31.6
3	36.4	31.3	35.5	35.1	28.9	32.9
4	36.0	28.8	34.8	35.4	29.5	33.6
5	37.1	30.8	35.9	37.0	30.8	34.9
6	36.5	30.1	34.9	36.5	28.9	34.0

Fig. 11 presents a radar plot delineating the temperature disparities prior to and subsequent to ablution for various individuals. The findings reveal a decrease in average temperature for each participant following the performance of ablution. Due to the relatively high temperature of the human body, a minimal quantity of water dispersed on the face may not yield a substantial temperature difference as it is counterbalanced by the body's warmth. Consequently, even minor temperature alterations post-ablution are deemed acceptable for distributing spray water on the designated body parts for ablution.

The results suggest that the thermal imaging technique can effectively detect temperature variations on the human body before and after ablution, even if the magnitude of change is minimal. The colour contrast depicted in Fig. 10 signifies the difference in facial surface temperature, which also serves as an indicator of water concentration in specific regions when examining post-ablution images.

A primary objective of this research is to explore the potential for integrating the Sunnah of the Prophet regarding water consumption during ablution into contemporary practices, leveraging modern technology. The employment of a mist spray device in ablution procedures has demonstrated a substantial decrease in water usage. Table 4 offers a comparative analysis of water consumption levels during ablution in both contemporary practice and the Sunnah. The data reveals that utilizing Sprayer B, or the mist spray device, results in a remarkable reduction in water consumption, exceeding 99%. Given the advancements in technology and the uniform distribution of mist across the surface of body parts involved in ablution, it is anticipated that water consumption could be diminished by over 90% when compared to the quantity utilized by the Prophet. Consequently, within the context of ablution, there exists a narration that emphasizes the prohibition of israf, or the excessive use of water. This aligns with a hadith from Abdullah Ibn Amru bin Al Ash RA, where he said: The Messenger of Allah passed by Sa'd when he was performing ablution, and he said: “What is this extravagance?” He said: “Can there be any extravagance in ablution?” He said: “Yes, even if you are on the bank of a flowing river.” Sunan Ibn Majah (425).

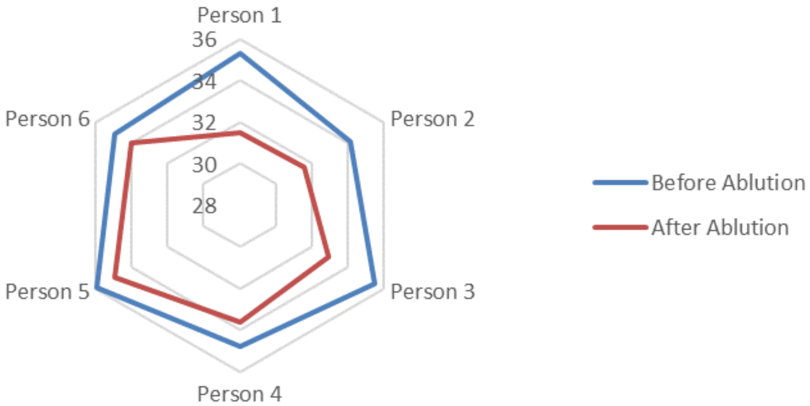


Fig. 11 - Radar chart of Average of temperature difference before and after ablution using mist spray prototype

Table 4 - Comparison of water usage with different type of ablution and the sunnah of the Prophet

Water Source	Water Consumption, ml	Percentage from Sunnah (687 ml)
Tap Water	5000 – 7000	700% - 1000%
Sprayer B	40 – 60	5% - 9%
Mist Spray Prototype	30 - 50	4% - 10%

5. Conclusion

The image processing analysis methodology suggested for examining spray distribution and coverage on the target surface can be employed to validate the uniformity of the spray nozzle in an ablution spray apparatus. Various spray nozzles can be utilized in the development of an ablution spray device; however, a nozzle that yields maximum coverage on the target surface is deemed the most effective choice for incorporation into an ablution mist spray device. In this investigation, a 0.6 mm nozzle was selected. The chosen nozzle generates extensive spray coverage, making it appropriate for conducting ablution. To confirm the spray uniformity on the body parts designated for ablution, the thermal imaging technique demonstrated persuasive outcomes in tracking temperature variations of the body parts before and after the ablution procedure. The shift in thermal colour contrast following ablution signifies water concentration and denotes that water has been distributed evenly on the body parts specified for ablution, with an average temperature difference of 2°C. The findings of this study suggest that mist spray applications for ablution hold potential for locations with restricted water resources or where water infiltration could lead to electrical malfunction. To ensure endorsement and authorization from Islamic jurisprudence, further deliberation and consultation are advised. Future recommendations include engaging with pertinent authorities to discuss the project scope and obtain their insights regarding the utilization of mist spray for public ablution. Moreover, additional research could focus on optimizing the design and functionality of the mist spray device to cater to diverse environments and user requirements.

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