

Russell, 1999). With the increasing popularity of hand sanitizers, focus should be on preparation of such substance that on one hand is beneficial to the human health and doesn't affect the environment in any way on the other hand. This can be achieved by reducing the amount of alcohol and other harmful chemicals that are being used by the industries. Herbal hand sanitizers prepared by the extracts of various herbs and spices can play an important role as the alternatives to the alcohol-based sanitizers. These are easily available, cost effective, more acceptable to the people as they show negligible side effects.

Herbs (*Aloe vera* and *Ocimum sanctum*) (Riyazi and Nejat-zadeh, 2020) and the spices (Cinnamon, *Trachyspermum* and *Nigella*) are loaded with anti-microbial activity. (Guerra et al, 2012; Sivropoulou et al, 1996; Nawahwi and Malek, 2013)

#### Materials and Methods :

Preparation of Nutrient Agar : Nutrient Agar medium was prepared and autoclaved for sterilization at 15 lbs for 15 min. The media was then put into plates for bacterial growth.

Preparation of herbal extract : Extracts were prepared after collection of the herbs and spices and a clear solution was obtained at last. 100 gms of each herbs were weighed, grinded into fine powder. 100 ml of distilled water was added to the powder and ultrasonicated for 2 hours. The solution was filtered into a pre sterilized volumetric flask. The flask was then kept under UV light for 20 minutes to check the growth of bacteria.

Test of antibacterial properties : Swabs were taken before and after application of herbal hand sanitizer. Swabs were also collected from the hands of volunteers after application of alcohol-based hand sanitizer. Swabs were then inoculated into nutrient agar plate. Plates were incubated at 37°C for 24 hours and then colonies were observed.

Physicochemical characteristics of herbal hand sanitizer : Color and odour of formulated sanitizer was done visually. pH was measured using pH meter. TDS and Conductivity was measured using Eutech PCD 650 multimeter. Turbidity was measured by turbidity meter.

DPPH assay (1, 1-diphenyl-2-picrylhydrazyl) : DPPH Assay was performed with the obtained hand sanitizer to test the anti-oxidant activity . all reading were taken in triplicate.

#### Results and Discussion :

The physical evaluation parameters are mentioned in Table 1.

**Table 1. Physical Evaluation Parameters**

Sl. No.	PARAMETERS	OBSERVATIONS
1.	Colour	Mustard Yellow
2.	Odour	Pleasant
3.	pH	6.9
4.	Turbidity	10 NTU
5.	Conductivity	236 $\mu$ S
6.	TDS	290mg/L

The pH of the solution was near to neutral. Turbidity was recorded to be 10 NTU. Conductivity was measured to be 236 $\mu$ S and Total Dissolved Solids (TDS) was recorded 290 mg/L.

Number of colonies that were observed on the plates are mentioned in Table 2

**Table 2. Number of colonies Microbial Growth on plates (mean  $\pm$  SE).**

Sl. No.	Control	Alcohol Based Sanitizer	Herbal Hand Sanitizer
Volunteer 1	64 $\pm$ 0.78	No colony growth	22 $\pm$ 0.47
Volunteer 2	51 $\pm$ 0.81	No colony growth	18 $\pm$ 0.79
Volunteer 3	49 $\pm$ 0.83	No colony growth	04 $\pm$ 0.52

The growth of the bacterial colonies was represented in colony counter. In the plates of the volunteer 1 the colonies isolated before and after the application of herbal hand sanitizer were reported to be 64 $\pm$ 0.78 and 22 $\pm$ 0.47 respectively.

Colonies isolated from the hands of volunteer 2 were found to be  $51 \pm 0.81$  and the value became  $18 \pm 0.79$  after the application of herbal hand sanitizer. The final sets of plates isolated from the hands of volunteer 3 were reported to be  $49 \pm 0.83$  and  $04 \pm 0.52$  before and after application of hand sanitizer respectively. The DPPH assay results are portrayed in the Table 3.

**Table 3. Result of DPPH scavenging activity of extracts for antimicrobial property.**

Extracts	OD (in nm)	% inhibition
<i>Aloe vera</i>	$0.764 \pm 0.21$	6.9 %
<i>Ocimum</i>	$0.876 \pm 0.19$	7.6 %
<i>Cinnamon</i>	$0.713 \pm 0.54$	6.6 %
<i>Nigella</i>	$0.834 \pm 0.16$	7.2%
<i>Trachyspermum</i>	$0.879 \pm 0.35$	7.6%
Herbal Sanitizer	$0.881 \pm 0.28$	8.2 %

DPPH assay was conducted to test the anti-oxidant activity of the herbal hand sanitizer. The overall value of the sanitizer was found to be highest among individual extracts collected of the herbs and spices. It was reported to be 8.2%. The individual values of the extracts were reported to be 6.6% of Cinnamon, 6.9 of *Aloe vera*. *Nigella* showed 7.2% inhibition. *Ocimum* and *Trachyspermum* showed equal values of 7.6%.

Hand sanitizers in the prevailing times have come out as of utmost importance. These being available in different forms such as liquid, foam or gel are very much convenient. Some advantages of hand sanitizers are:

- These take less time than conventional washing of hands with soap and water.
- Act fast to kill the microorganisms and are easy and quick to use.
- Are far more accessible than a sink is.
- Slow down the redevelopment of microorganisms.

As these are gaining popularity among the masses for the purpose of hygiene, focus should be

on preparation of a substance that on one side is beneficial to the human population as well as to the environment on the other side. This can be achieved if the amount of harmful chemicals in addition to alcohol is reduced or replaced by items that are naturally occurring and can provide us with both the human health and environment aspect. Thus, we prepared hand sanitizer that contained herbs and spices as their major constituents.

Various tests were done to check the efficacy in terms of antimicrobial activity as well as the other properties of the herbal hand sanitizer such as DPPH assay, turbidity and conductivity etc. in which the values stood standard.

The overall DPPH scavenging activity of the hand sanitizer was reported to be 8.2%. DPPH method was performed to test the anti-oxidant activity of the herbal hand sanitizer. DPPH method is simple, quick and cost effective and provides accurate results. (Prakash, 2001).

### Conclusion:

Our hand sanitizer comprised mainly of herbs and spices (*Aloe vera*, Holy Basil, Cinnamon, *Trachyspermum* and *Nigella*) and it was found safe to use with exemplary results. No side effects including irritation or itching were reported from the hands of the volunteers. The physical as well chemical parameters were also found to be of standard levels. It was found that the herbal hand sanitizer was able to reduce the bacterial growth, although less than the alcohol-based sanitizer. But other concentrations may be needed to act upon a wide spectrum. It was reported that the sanitizer has significant anti-microbial property. Therefore, there is an immense potential in the herbal hand sanitizer as a measure to check the spread of infection through microorganism present on the hands.

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