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Extractive Values of Different Medicinal Plants

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ABSTRACT: Medicinal plants are important sources of biochemical compounds for pharmaceutical and different nutraceutical industries, but their extraction efficiency varies significantly with regional agro-climatic conditions. The main objective was to identify region-specific yield variation to guide future phytochemical investigations and industrial applications. Medicinal plants Allium sativum , Aegle marmelos, Ocimum sanctum, Azadirachta indica, Mentha spicata, Coriandrum sativum and Murraya koenigii were collected from six cities in Gujarat. The different extractive values found establish a framework for prioritizing high-yield plant material in future phytochemical profiling and pharmaceutical applications, enabling efficient selection of optimal sourcing locations for standardized herbal product manufacturing and drug discovery programs.

1.0 INTRODUCTION

For thousands of years, medicinal plants have been used as natural sources of therapeutic compounds to treat a variety of ailments and maintain health.[1] The World Health Organization reports that more than 80% of the world's population uses traditional medicine, mostly derived from plants, to address basic medical needs. Every year, the gathering and processing of medicinal plants and plant products make up a significant portion of India's economy and provide both full-time and part-time employment.[2]

Medicinal plants have had a major impact on the development of human civilization. Medicinal plants have long been utilized as a source of medicine in practically every culture and civilization. [3] Approximately 3000 plant species are known to have medicinal properties in India [4]. Many modern medications are made from medicinal plants, which are considered to be abundant sources of traditional medicines.[5] Medicinal plants have been used for thousands of years to treat illnesses, preserve food, add flavour, and stop disease outbreaks.[6] The biological traits of plant species used globally are typically due to the secondary metabolites they produce. Because of their natural origin, accessibility in local communities, affordability, ease of administration, and potentially fewer side effects, plants are becoming increasingly popular as a source of medicine worldwide. Additionally, herbal medicine could be a helpful substitute for medication when there are a lot of side effects and drug resistance. [7]

In pharmaceutical terms, extraction refers to the process of using selective solvents in standard extraction procedures to separate the medicinally active parts of plant or animal tissues from the inactive or inert components. These plant-based products are comparatively impure liquids, semisolids, or powders that are only meant to be used externally or orally.[8]

2.0 THERAPEUTIC ACTIVITY

Many biological activities, such as anticarcinogenic, antioxidant, antidiabetic, renoprotective, anti-atherosclerotic, antibacterial, antifungal, and antihypertensive properties, have been reported for *Allium sativum* and its related compounds.[9] Major phytochemicals in oregano sulfur compounds, like allicin, which is formed from alliin by alliinase when crushed, diallyl sulfide (DAS), diallyl disulfide (DADS), diallyl trisulfide (DATS), ajoene, and S-allyl-cysteine (SAC), are found in *Allium sativum.* [10]

Aegle marmelos has therapeutic potential and contains components that may be utilized to create new drugs for the treatment, prevention, or mitigation of cancer, diabetes, and other pathogenic diseases. [11] Among the important alkaloid phytochemicals present in *Aegle marmelos* are aegeline, marmesin, and marmelosin. [12]

Ocimum sanctum has immunomodulatory, antifertility, and anticancer properties, suggesting a variety of roles in health care. Its therapeutic adaptability is demonstrated by its efficacy in treating conditions like kidney stones and psychological stress.[13] Fresh leaves and stems of *Ocimum sanctum* contain substantial amounts of eugenol along with phenolic compounds like cirsilineol, circimaritin, isothymusin, apigenin, and rosmarinic acid. The leaves also contain luteolin, apigenin-7-O-glucuronide, luteolin-7-O-glucuronide, vicenin, ursolic acid, and molludistin. [14]

Pharmacological characteristics of *Azadirachta indica* include hypolipidemic, antifertility, microbicidal, antidiabetic, anti-inflammatory, hepatoprotective, antipyretic, hypoglycemic, insecticidal, antiulcer, antioxidant, neuroprotective, cardioprotective, and antileishmaniasis effects. Alkaloids, steroids, flavonoids, terpenoids, fatty acids, and carbohydrates are just a few of the phytochemicals for pharmaceuticals that are found in *Azadirachta indica*. [15]

The stems of *Mentha spicata* are used to treat intestinal ailments, and the leaves have been decocted to treat gastric disorders. [16] Natural phenolics and essential oils are among the valuable phytochemicals that are extracted from *Mentha spicata*. [17] [18]

Coriandrum sativum has antioxidant, anti-inflammatory, antimicrobial, hypoglycemic, hypolipidemic, neuroprotective, and other pharmacological properties attributed to a wide range of bioactive components found in phytochemical studies, such as flavonoids, terpenoids, and essential oils.[19]

Carbazole alkaloids, which have strong biological and pharmacological effects, are abundant in the leaves, roots, and bark of *Murraya koenigii*. These include neuroprotective, anti-inflammatory, antitumor, antidiabetic, and antioxidant properties. [20]

3.0 MATERIALS AND METHODS

3.1 Gathering plants

The fresh, healthy leaves of *Allium sativum, Aegle marmelos, Ocimum sanctum*, *Azadirachta indica, Mentha spicata, Coriandrum sativum,* and *Murraya koenigii* were collected uniformly from Anand, Surat, Ahmedabad, Mehsana, Rajkot, and Vadodara, Gujarat, India.

3.2 Techniques for extraction

The leaves were cleaned to get rid of any dust before being shade-dried and ground into a fine powder with a mixer grinder. After that, the powder was gradually soaked in solvent inside a sterile flask. Periodically, the contents are stirred. At the conclusion of extraction, a micelle is extracted from the marc by filtration. *Allium sativum, Aegle marmelos, Ocimum sanctum*, *Azadirachta indica, Mentha spicata, Coriandrum sativum*, and *Murraya koenigii* plant leaves were finely powdered, respectively [21].

3.3 Statistical Analysis

The statistical investigation was implemented through standard statistical procedures. The graph making and statistical analysis were carried out using software such as Excel and IBM SPSS Statistics 26. We performed all the data analysis in this research using the mean (n=3) and standard deviation.

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4.0 RESULT AND DISCUSSION

Medicinal plants are extracted, processed, and either prepared for use in experiments or directly consumed as herbal or traditional medicine. The idea of preparing medicinal plants for experimentation entails timely and appropriate plant collection, sufficient drying, and grinding.[22]

Standardized extraction processes for crude drugs aim to remove the inert material by treating it with menstruum, a selective solvent, and to obtain the therapeutically desired portion. The resulting extract can be prepared for use as a medicinal agent in the form of tinctures and fluid extracts, or it can be fractionated to isolate specific chemical entities that are contemporary medications, or it can be further processed to be incorporated in any dosage form like tablets or capsules. Therefore, the final quality of the herbal medication is greatly influenced by the standardization of extraction processes.[23]

Ahmedabad showed the highest extraction yields for *Allium sativum* 24.20±0.92 %w/w, *Aegle marmelos* 22.43±1.54 %w/w, *Ocimum sanctum* 20.43±0.54 %w/w, and *Coriandrum sativum* 22.56±1.69 %w/w. In Vadodara, it showed the maximum yields for *Azadirachta indica*, which is 22.98±1.62 %w/w. Rajkot demonstrated superior extraction for *Mentha spicata*, with 19.73±0.69 %w/w. Mehsana and Anand exhibited moderate yields across most species, with *Murraya koenigii* showing its highest yield in Mehsana at 17.87±0.63 %w/w. The lowest yield observed in Vadodara for Mentha spicata was 10.00±0.81 %w/w, and for *Coriandrum sativum* it was 9.70±0.49 %w/w, and in Ahmedabad for *Azadirachta indica* it was 10.59±0.63 %w/w.

Global climate change is modulating the weather conditions of the same geographical area, which in turn has a significant impact on the secondary metabolite production rate and composition in organized medicinal plant extracts. Weather conditions, rainfall, and humidity vary by geographical location, which may affect the phytometabolite composition and yield of the same species of medicinal plant when grown in different areas.[24]

Minerals and much of the organic content in the soil directly impact the metabolic pathway of any plant, which changes the concentration of different metabolites and oils.[25] In this research, the variation in extraction yield across geographical locations can be attributed to several environmental and agronomic factors, including soil composition, climate, cultivation practices, and genetic variability of plant populations. The significantly higher extraction yield observed in Ahmedabad for four out of seven species is due to favourable edaphic and climatic conditions for secondary metabolite accumulation in these plants. Vadodara exhibited the lowest yields for *Mentha spicata* and *Coriandrum sativum,* potentially due to higher humidity levels that may not be optimal for these species. However, Vadodara showed the highest yield for *Azadirachta indica,* indicating that it may be better adapted to local environmental conditions in this region.

When comparing the overall performance across locations, Ahmedabad emerged as the most favourable location for maximum extraction yield, with four species showing their highest values here. Rajkot and Vadodara each showed one species with peak yields, indicating location-specific optimization. Surat and Anand displayed intermediate yields, showing moderate suitability for medicinal plant cultivation.

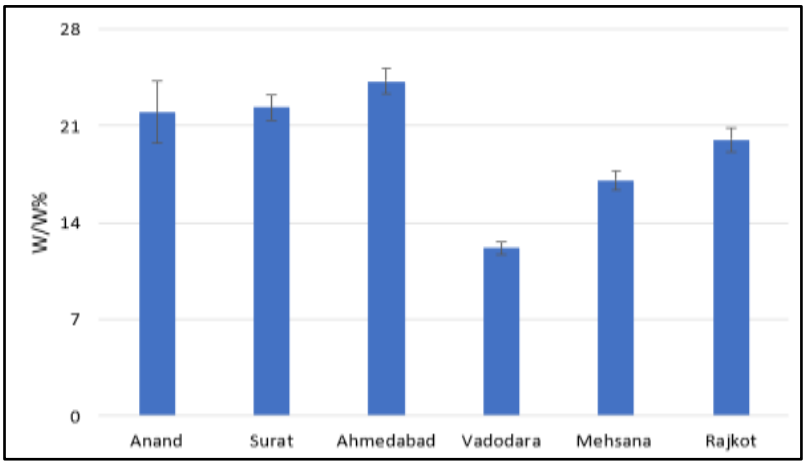


Fig 1: Extraction content of *Allium sativum*

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Every value was shown as the mean, where n=3. Also, the standard deviation(SD) of the data is specified by the error bar.

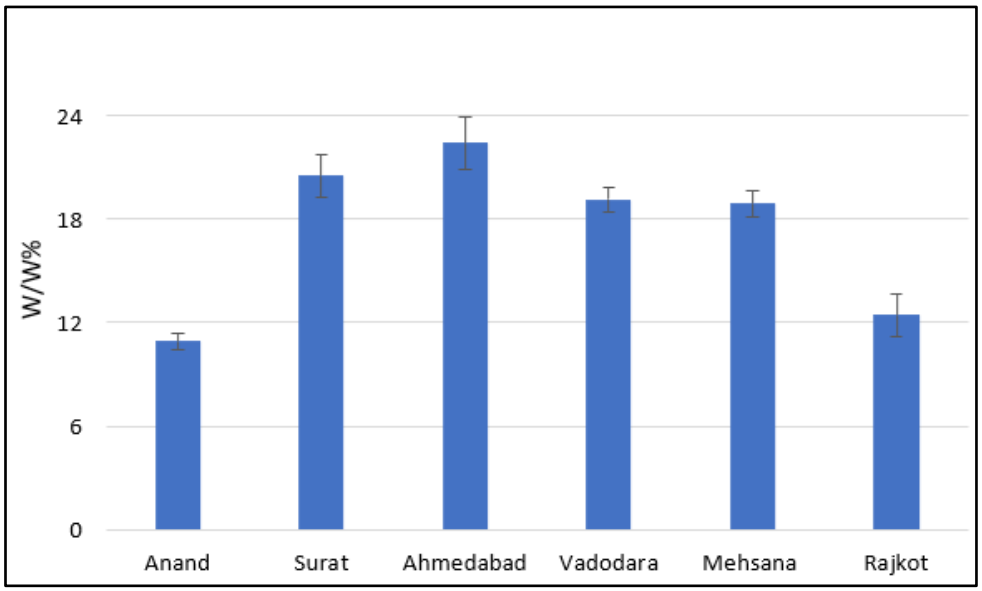


Fig 2: Extraction content of *Aegle marmelos*

Every value was shown as the mean, where n=3. Also, the standard deviation(SD) of the data is specified by the error bar.

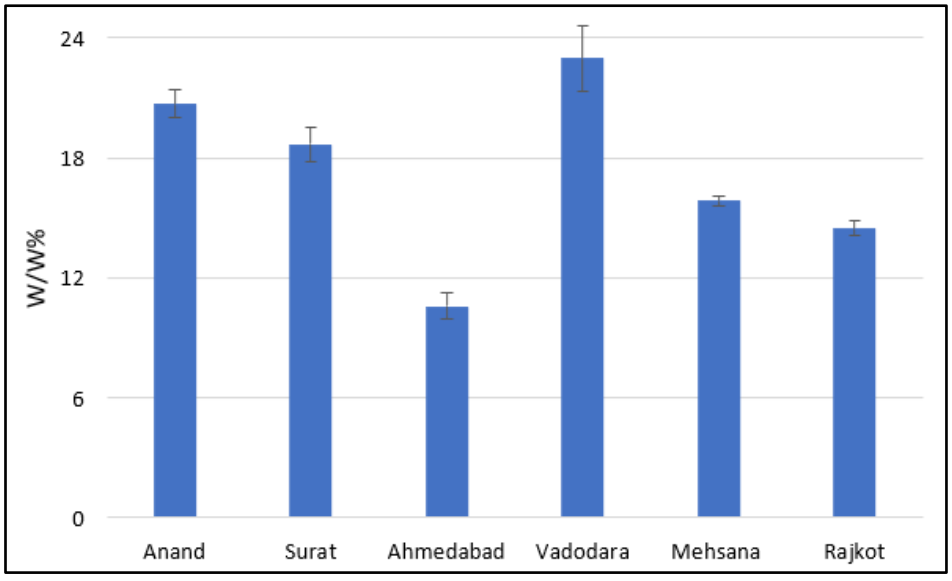


Fig 3: Extraction content of *Azadirachta indica*

Every value was shown as the mean, where n=3. Also, the standard deviation(SD) of the data is specified by the error bar.

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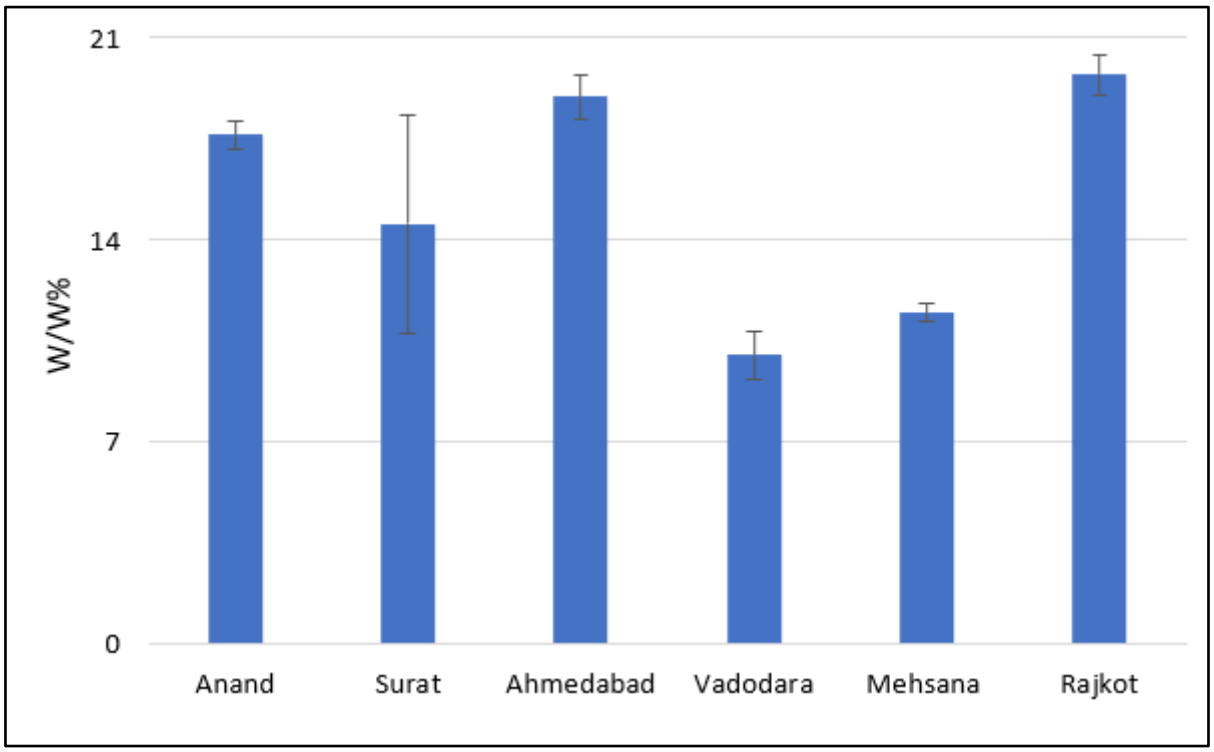


Fig 4: Extraction content of *Mentha spicata*

Every value was shown as the mean, where n=3. Also, the standard deviation(SD) of the data is specified by the error bar.

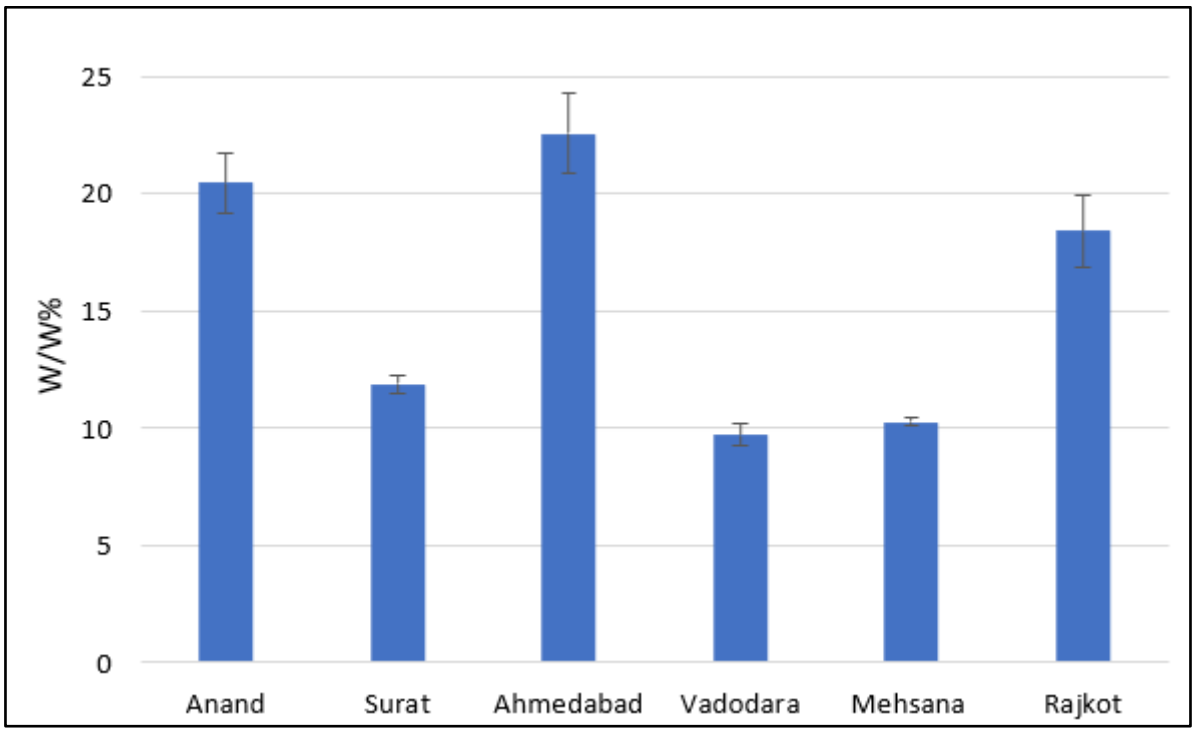


Fig 5: Extraction content of *Coriandrum sativum.*

Every value was shown as the mean, where n=3. Also, the standard deviation(SD) of the data is specified by the error bar.

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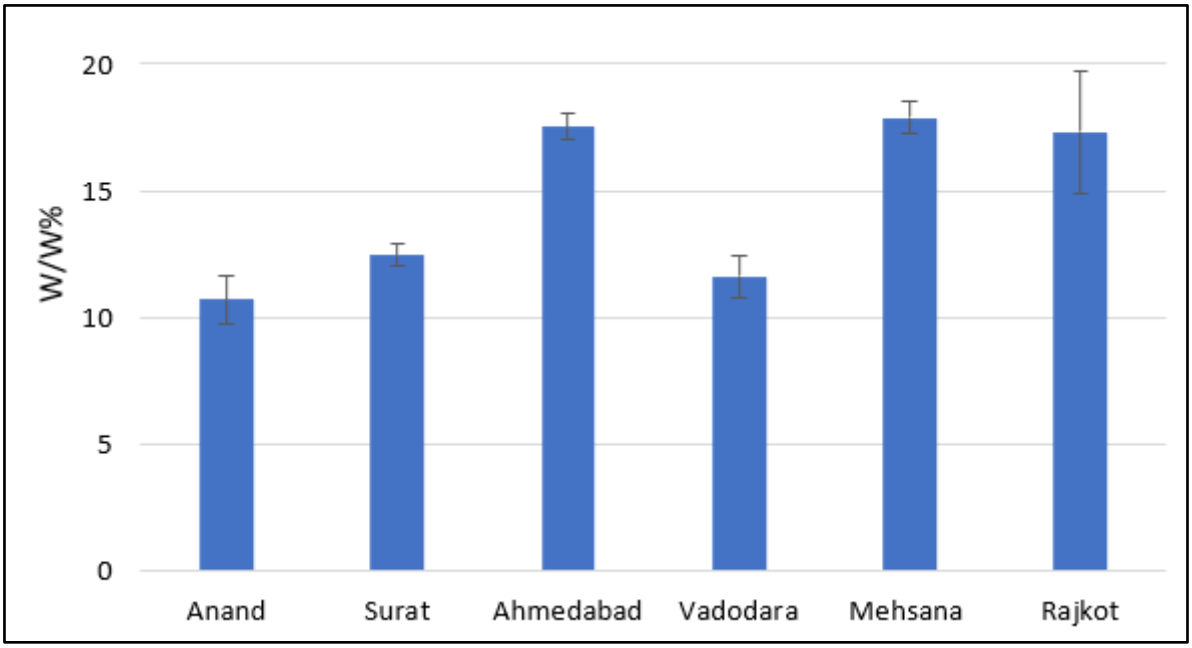


Fig 6: Extraction content of *Murraya koenigii*.

Every value was shown as the mean, where n=3. Also, the standard deviation(SD) of the data is specified by the error bar.

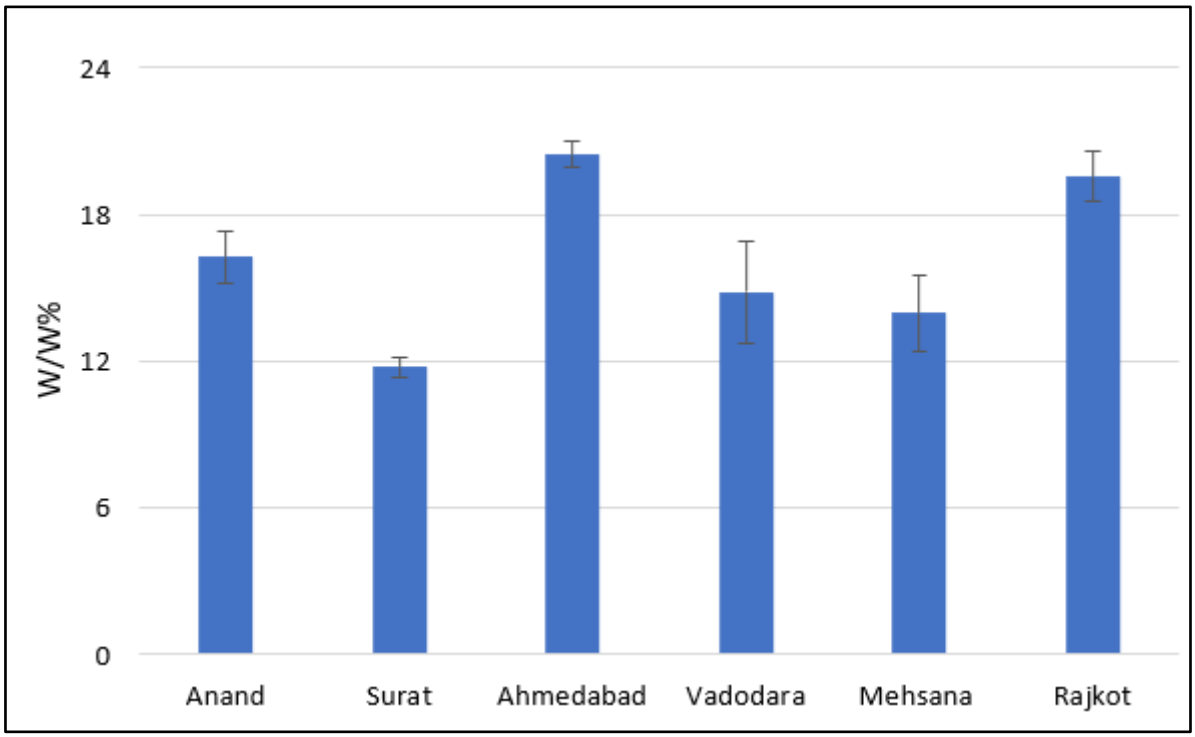


Fig 7: Extraction content of *Ocimum sanctum*

Every value was shown as the mean, where n=3. Also, the standard deviation(SD) of the data is specified by the error bar.

5.0 Conclusion

This study provides a comprehensive analysis of extraction yield variation across six different locations in Gujarat for seven medicinally important plant species. The findings identify region-specific optimal cultivation zones that can guide future

phytochemical investigations, pharmaceutical development, and industrial applications. This research contributes to the efficient utilization of medicinal plant resources and the advancement of evidence-based natural products for human health.

Conflict of interest

The authors declare that they have no conflicts of interest to disclose.

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