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# Research on Toothbrush Trees Leading to the Social, Environmental and Business Ideas

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**Abstract** - *Salvadora* or the toothbrush tree (miswak) originates from Pakistan, India, South Africa and West Asian countries. The fibrous branch is packed in a pen-shaped holder, as an innovative form and marketed internationally. This prophetic and endangered, medicinal plant genus is promoted by the World Health Organization. The extracts are now extensively used in dentistry. The products are manufactured in pharmaceutical and cosmetics industries, as the toothpaste, tooth gel and mouth rinse. In this study, a literature search on *Salvadora* is conducted. Both miswak articles and products are available online. The journals on *Salvadora* were systematically reviewed. Here, a parallel update of this natural resource, plus its business and entrepreneurship, are presented. A clinical trial was performed to investigate the effect of mouth wash, extracted from *S. persica* on dental plaque formation. The antiplaque efficacy of the miswak mouth rinse, in comparison to that of chlorhexidine, was recently published. Meanwhile, the chemistry of *S. oleoides* was studied. A number of molecules were isolated from various parts of the plant, including the leaves, seeds, stems and roots. They consist of salvadorin; a dimeric dihydroisocoumarin, phytosterols e.g. *beta*-sitosterol and its glucosides, fatty acids, essential oils, salvadoricine; an indole and the sulfur-containing organic substance, known as salvadoside. Nevertheless, artifacts could be produced, following the alcoholic extraction of *Salvadora* species. Attempts on the synthesis of analogues of *Salvadora* alkaloid were also made. It is anticipated that more research could be carried out for the economic benefit of this plant.

**Keywords** - business, miswak, products, review, *Salvadora*

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## I. Introduction

*Salvadora* or the miswak is classified in merely eleven-membered species of Salvadoraceae plant family. It originates from India, South Africa and West Asian countries. All plant parts of *Salvadora* possess the medicinal, pharmaceutical, industrial and nutritional importance (Akhtar et al. 2011). An indigenous, oral hygiene tool could consist of the fibrous branch of *Salvadora* species (Haque et al. 2015; Abdul Majeed, 2017). Nowadays, it could be packed in a pen-shaped holder, as an innovative form and marketed internationally. This prophetic and endangered, medicinal plant genus is promoted by the World Health Organization. The plantation of *Salvadora* species e.g. in Pakistan, could not only increase vegetation, but also provide food, forage, fodder and medicine for the people of desert zones. The commercial propagation of this species could be performed through seed and root suckers (Nafees et al. 2019). In this study, a literature search on the so-called toothbrush tree is conducted. Reports on miswak, research findings and products are available online. The journals on *Salvadora* were systematically reviewed. Here, an update of this species in the aspects of scientific

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investigations, social, environmental and entrepreneurship, is presented.

## II. The medicinal uses of *Salvadora* species

The pharmacology and medicinal uses of *S. oleoides* were reported. It possessed anti-hypoglycemic, hypolipidemic, analgesic and antimicrobial activities (Garg et al. 2014; Kumar et al. 2019). Ramli et al. (2016) presented the benefits of miswak in dentistry. Earlier, a clinical trial was launched to study the effect of miswak (*S. persica*) extracts as mouth wash on dental plaque formation (Al-Bayaty et al. 2010a). Miswak ethanol extract has strong antibacterial effect against periodontal pathogenic bacteria. It was proposed as a good alternative mouthwash to control and inhibit periodontal pathogenic bacteria (Al-Bayaty et al. 2010b).

## III. The chemistry of *Salvadora* plants

The research of *Salvadora* plants were performed. The chemistry of this resource could be understood by extracting the natural components. For example, salvadoricine is known as the nitrogenous compound from the leaves of *S. persica* (Malik et al. 1987) (Figure 1). Recently, the effect of hydroxylated solvents on the active constituents of *S. persica* root was studied (Abdel-Kader et al. 2019). In addition, the structure of salvadorin, a dimeric dihydroisocoumarin from *S. oleoides*, was determined by spectroscopic methods (Mahmood et al. 2005). Comparative secondary metabolites profiling and biological activities of aerial, stem and root parts of *S. oleoides* was investigated (Saleem et al. 2019). Meantime, it was found that the antimicrobial activity of *S. persica* was due to the presence of benzyl isothiocyanate (Abdel-Kader et al. 2019). Nevertheless, the artifact could be produced (Figure 2), following the alcoholic condition. Precaution steps should be taken during extraction, since hydroxylated solvents such as the alcohols, were able to react and modify the structure of the active benzyl isothiocyanate, thus diminishing the antimicrobial activity. Other products which are associated with strong antibacterial property, consist of the natural compounds from *Alternaria* species, an endophytic fungus isolated from *S. persica* (Elgorban et al. 2019). Synthesis of the analogues of *Salvadora* alkaloid (Figure 1) were also performed (Stremski et al. 2018).

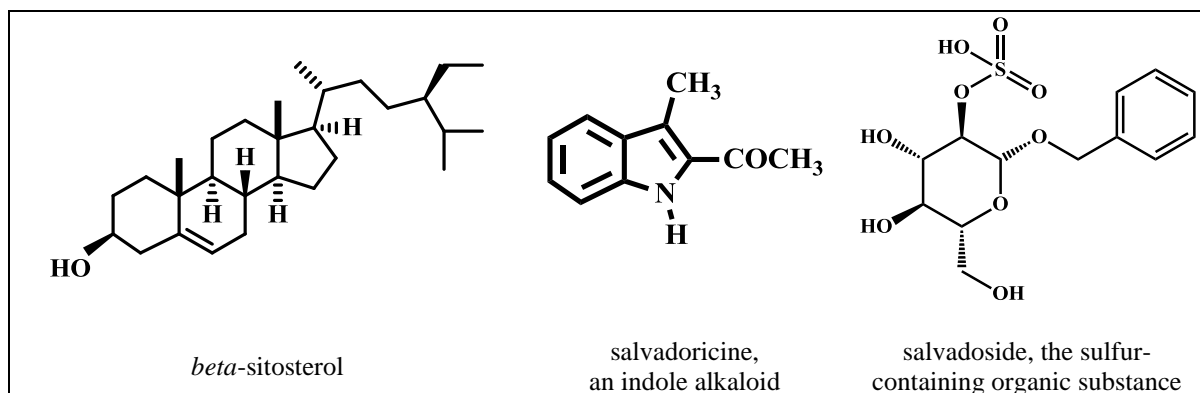


Figure 1 – The organic compounds in *Salvadora* extracts.

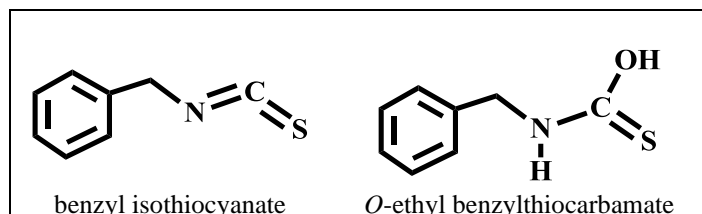


Figure 2 – The benzyl isothiocyanate in *S. persica* root and its artifact.

Table 1 provides the publications of reviewed papers on *Salvadora* species. *S. persica* was reported as an effective oral hygiene aid. It may be recommended for regular use, given its favourable effects on oral health, low cost, availability and simplicity of use (Halawany, 2002). The ongoing research on this folklore toothbrush trees prominently lead to the business and entrepreneurship ideas.

**Table 1 - The review articles on *Salvadora* species**

Source	Key points
Halawany, 2002	Review on <i>S. persica</i> and its effect on various aspects of oral health
Akhtar et al. 2011	Review on phytochemical and pharmacological investigations of <i>S. persica</i>
Garg et al. 2014	Review on phyto-pharmacological study of <i>S. oleoides</i>
Haque et al. 2015	Review of the therapeutic effects of using <i>S. persica</i> on oral health
Abdelmagyd et al. 2019	Review of clinical trials using herbs as adjunct in periodontal therapies
Jassoma et al. 2019	Review of the antiplaque efficacy of <i>S. persica</i> mouth rinse, in comparison to chlorhexidine
Nafees et al. 2019	Review on the status and future prospects of endangered <i>Salvadora</i> species
Şener et al. 2019	Review of the herbal extracts used in dental disorders.

#### IV. The business and entrepreneurship of miswak

The research and development conducted on *Salvadora* plants lead to positive influences towards entrepreneurial intentions (Kasuma et al. 2019) and advanced, marketable items. The extracts are now extensively used in dentistry. The products are manufactured in pharmaceutical and cosmetics industries, as the toothbrush (Miswak, 2018), toothpaste or tooth gel (Halagel, 2020) and mouth rinse (Listerine, 2019). The miswak products, especially the mouth wash, were more effective in reducing the growth of cariogenic bacteria, than the ordinary toothpaste (Al-Dabbagh et al. 2016). The innovative miswak products are introduced. It consists of bristles, made from the roots and twigs of *S. persica*, created from Japanese technology (Miswak OnPay, 2020). In another merchandise, it includes a pen-shaped holder, which contain the fibrous, chewing *Salvadora* branch or twig/stick (MYGIC, 2020; Figure 3). Another sample of the miswak pen also provides a fresh, small cut of the twig, which can be stationed at the end of the pen. The refill miswak in vacuum-sealed pack and the cutter could be delivered to the customers (This Toothbrush, 2020).



**Figure 3 – Examples of the miswak pen.**

Nevertheless, the challenges in miswak business are obvious. Since the toothbrush, toothpaste and the floss have been used for so long, the westerners are less likely to change their brushing habits (Peters, 2015). Intercultural knowledge is indeed required, in order to understand the needs of global populations (Denner, 2018) for the start-up of the miswak business. In addition, the disadvantages of miswak use were listed (Haque et al. 2015). Meantime, the miswak business could add into the social business (Musa, 2019), as provided by another form of miswak. It is referred as a unique form due to its material. It is made from the premium olive trees, planted in the Kashmir valleys. A part of the miswak sales proceeds to financing a refugees' school in Malaysia (Royal Miswak, 2020).

## V. Conclusion

*Salvadora* is an arid horticultural species and forest crop. It can be successfully grown in harsh conditions and is at risk of extinction. However, sustainability can be achieved through cultivation of such plants. It is anticipated that more research could be carried out for the economic benefit of this multipurpose *Salvadora* trees. The uses of miswak is associated with health, social, cultural norms and religious beliefs, and could be exploited for human well-being. In short, the prophetic practice could be revived by the means of business and entrepreneurship of miswak.

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