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THE POTENTIAL OF SNAKE PLANT (SANSEVIERIA TRIFASCIATA) EXTRACT AS AN ANTI-POLLUTION PRODUCT

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ABSTRACT

The Potential of Snake Plant (Sansevieria trifasciata) Extract as an Anti-Pollution Product. *Air pollution is one of the major environmental issues that directly affects human health, particularly in enclosed spaces with limited air circulation. Several studies have shown that indoor air contaminant levels are often higher than those found outdoors. Meanwhile, the use of conventional air filtration devices tends to be expensive and less environmentally friendly. This article aims to evaluate the effectiveness of Sansevieria trifasciata (commonly known as snake plant) in reducing indoor air pollution through a literature review approach. The review involved the examination of 15 scientific articles from national and international journals. After screening based on inclusion criteria, 11 articles were selected for further analysis. The results indicate that Sansevieria trifasciata can reduce carbon monoxide (CO) levels by up to 84.18%, absorb formaldehyde up to 30%, and capture other harmful compounds such as benzene and ammonia. These findings suggest that the snake plant has the potential to serve as a natural, economical, and sustainable solution for improving indoor air quality.*

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INTRODUCTION

Air pollution is one of the major environmental issues that significantly affects human health. According to the Decree of the Minister of Population and Environment No. Kep-02/Men-KLH/1988, air pollution is defined as the entry of living organisms, substances, energy, and/or other components into the air as a result of human activities or natural processes, causing a decline in air quality to the extent that it can no longer function properly. The impacts of such pollution include health disorders, ecosystem damage, and climate change. Pollutant gases such as carbon dioxide (CO_2), formaldehyde, and fine particulate matter at high concentrations have been shown to increase the risk of respiratory illnesses, cancer, and impairments to the nervous and visual systems.

Indoor air pollution has become a growing concern due to the fact that exposure to pollutants in enclosed spaces may be higher than in outdoor environments, primarily due to limited air circulation. Several studies report that individuals spend more than 90% of their time indoors, thereby significantly increasing the risk of exposure to air contaminants. Additionally, the use of solid fuels, cigarette smoke, waste burning, and poor ventilation further degrade indoor air quality, both in urban and rural areas. This condition calls for effective, environmentally friendly, and affordable solutions for pollution control.

Various efforts have been made, ranging from air filtration technologies and regulatory measures to public awareness campaigns. However, many of the available technological solutions are costly and require complex maintenance. Therefore, natural alternatives such as the use of plants as pollutant absorbers have emerged as promising and sustainable options. Certain plants have been found to possess a natural ability to absorb air pollutants through the process of phytoremediation, one of which is Sansevieria trifasciata, commonly known as snake plant.

The snake plant is known for its high resilience to extreme environmental conditions and its ability to absorb a variety of air pollutants. It can thrive under various lighting conditions, contains active compounds such as saponins, and has been proven effective in absorbing carbon monoxide (CO), formaldehyde, and other harmful substances. Its thick, fleshy leaves and low-maintenance growth requirements make it an ideal natural air filtration medium for indoor environments.

The purpose of this study is to evaluate the effectiveness of Sansevieria trifasciata extract in absorbing indoor air pollutants through a literature review approach. The method employed in this study is a systematic review of scientific articles that discuss the plant's potential in air phytoremediation. This review is expected to provide a nature-based, applicable, and sustainable alternative solution for addressing indoor air pollution.

MATERIALS AND RESEARCH METHODS

This study employs a literature review method with a systematic approach to evaluate the effectiveness of Sansevieria trifasciata extract in absorbing indoor air pollutants. This approach was selected to collect and analyze findings from previous studies in an objective and structured manner. The procedure was conducted following the framework of a systematic literature review to minimize bias and reduce the risk of subjective misinterpretation by the researchers.

The article search process was carried out using five electronic databases: Google Scholar, SINTA, IOP Science, ScienceDirect, and ResearchGate. The search was conducted using the following combinations of keywords: "Sansevieria trifasciata," "anti-pollution," "indoor air pollution," and "environmental health." The search strategy is presented in the following table:

Tabel 1. *Database* dan *Keywoards*

Database	**Strategi Pencarian Artikel**
Google Scholar	"Sansevieria trifasciata", "Anti Pollution", "Enviromental health"
SINTA	"Sansevieria trifasciata", "Anti Pollution", "Enviromental health"
IOP Science	"Sansevieria trifasciata", "Anti Pollution", "Enviromental health"
Sciencedirect	"Sansevieria trifasciata", "Anti Pollution", "Enviromental health"
Research Gate	"Sansevieria trifasciata", "Anti Pollution", "Enviromental health"

The identified articles were subsequently screened based on their titles and abstracts to eliminate duplicates and irrelevant studies. The remaining articles were then read in full to ensure the relevance of their content to the research focus and to assess the methodological soundness.

The inclusion criteria for this study comprised scientific articles published from 2019 onward, in either national or international journals, that discuss the chemical composition, biological activity, or potential of Sansevieria trifasciata in reducing air pollution. Articles were also required to be available in full-text format and accessible online. Conversely, articles from non-credible sources such as blogs or websites without identifiable authorship, as well as studies lacking direct relevance to the research topic, were excluded during the screening process.

Article quality was assessed manually based on methodological rigor, consistency of presented data, and the relevance of findings to the research objectives. Although no formal

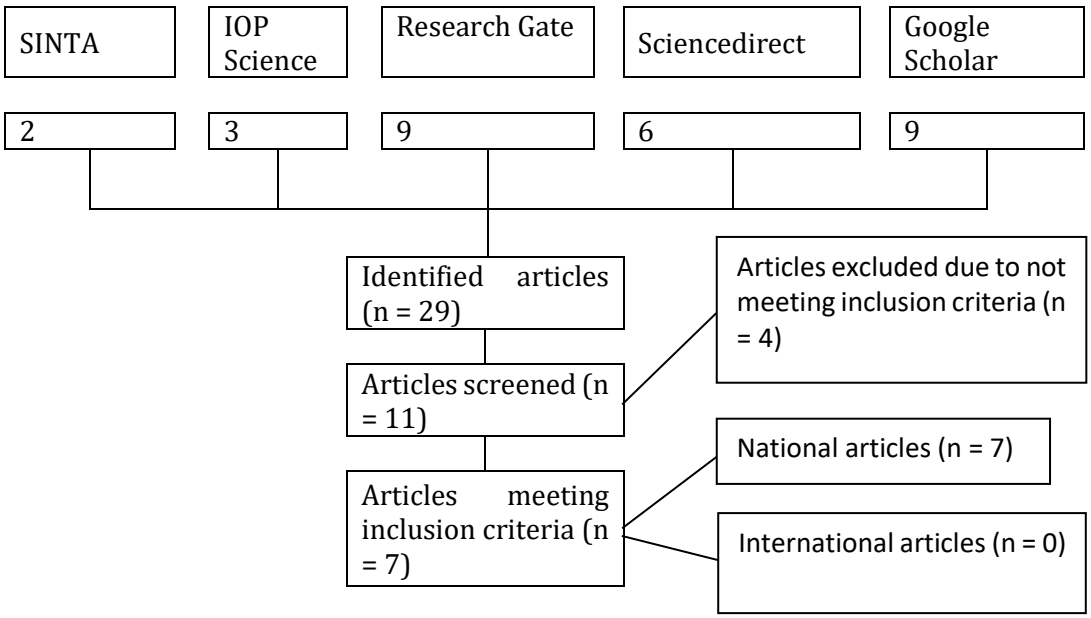
appraisal tools such as CASP or PRISMA-ScR were employed, the selection and analysis processes were conducted carefully and systematically to ensure that the conclusions drawn are scientifically accountable.

RESEARCH RESULTS AND DISCUSSION

The results of the literature search using the predetermined databases and specified keywords yielded a total of 4,128 articles. The researcher utilized several sources obtained through this search strategy across the selected databases. An initial screening was conducted to filter the articles based on relevance to the research topic, resulting in 29 articles that met the thematic criteria.

A second round of screening was then performed to further assess the articles based on the predefined inclusion criteria. This process resulted in 11 articles that were eligible for analysis according to their alignment with the inclusion criteria and methodological feasibility. However, 4 of the selected articles were excluded at this stage due to non-compliance with the inclusion standards.

The full process of article identification and selection is illustrated in the article selection flow diagram.



Source: Personal Documentation

Figure 1. Article Search Flowchart

The results of the studies analyzed by the researcher are summarized in the following table:

Table 1. Research Findings Matrix

Study/Author	Research Location	Sample Size	Research Method	Outcome
The Effectiveness of Snake Plant (Sansevieria trifasciata) Leaf Powder in Neutralizing Carbon Monoxide Levels in Cigarette Smoke	Indonesia, Univer-sitas Fort de Kock	8 samples, intervention group	The study employed an experimental research design using T-Test and ANOVA for statistical analysis.	The results of the study, based on univariate analysis, showed a decrease in carbon monoxide levels when snake plant leaf powder was used at time intervals of 6, 12, and 24 hours, followed by an increase at 48 hours. Bivariate analysis indicated that the most effective time was at 24 hours (p-value = 0.277) and 48 hours (p-value = 0.505). The findings suggest that snake plant (Sansevieria trifasciata) leaf powder is capable of neutralizing carbon monoxide levels in cigarette smoke. [10]
Effectiveness of Sansavieria trifasciata Extract Bracelet in Absorbing Carbon Monoxide (Co) in Cigarette Smoke.	Labora-torium FIBIGEN Muham-madiyah Univer-sitas Sukabumi	The sample in this study consisted of Sansevieria trifasciata leaves collected from the surrounding environment and home gardens in the Sukabumi city area.	The method used in this study was a true experimental design employing a Completely Randomized Design (CRD), consisting of three different treatments with three replications each.	The results of the three treatments indicated that P1 (Sansevieria trifasciata wet extract) had the ability to absorb carbon monoxide (CO) at an average rate of 12.67 ppm every 15 minutes. In comparison, P2 (Sansevieria trifasciata ethanol extract) demonstrated a much higher absorption capacity, removing 91.11 ppm of CO every 15 minutes. Meanwhile, P3 (a combination of ethanol extract and CMC from Sansevieria trifasciata leaves) absorbed CO at a rate of 37.89 ppm every 15 minutes and showed optimal performance over a period of 135 minutes. [11]
Absorption Capacity of Sansevieria Plants in Reducing Carbon Monoxide Pollutants.	Campus Laboratory of the Department of Environmental Health	The sample utilized a glass box chamber as the medium, with a carbon monoxide source and snake plant (Sansevieria trifasciata) as the pollutant-absorbing medium.	This study employed a pre-experimental design using a One-Group Pretest–Posttest design.	The conclusion of this study is that the average concentration of carbon monoxide pollutants before the introduction of Sansevieria was 64.27 ppm ± 11.87, while the average concentration after the treatment was 42.06 ppm ± 12.68. The results of the paired t-test showed a p-value of 0.01 ($p < 0.05$), indicating a statistically significant decrease in carbon monoxide levels following the introduction of Sansevieria plants. [12]
Study on the Reduction of Carbon Monoxide (CO) Concentration from Motor Vehicle Exhaust Using Snake Plant (Sansevieria sp.)	-	Two different exposure durations were used: motor vehicle exhaust was applied to snake plants (Sansevieria sp.) for 13 minutes and 30 minutes.	Descriptive Analysis	Based on the results of the study, it was found that snake plants (Sansevieria sp.) were capable of reducing carbon monoxide (CO) concentrations in the test chambers. The percentage reduction of CO per hour was 1.6% in Test Room 1, 1.38% in Test Room 2, 2.7% in Test Room 3, and 2.08% in Test Room 4. The reduction in CO concentration occurred more rapidly as the number of Sansevieria plants placed in the test rooms increased. This indicates that the quantity of Sansevieria plants plays a significant role in the effectiveness of CO absorption. [14]
The Potential of Snake Plant (Sansevieria trifasciata) Leaf Extract as a Carbon Monoxide Reducer in Cigarette Smoke	Indonesia	Snake Plant	Extraction Research Method	The extract of snake plant (Sansevieria trifasciata) has potential as a reducer of carbon monoxide in cigarette smoke. [15]
The Effectiveness of Snake Plant (Sansevieria trifasciata) and Lemongrass (Cymbopogon citratus) Extracts in Reducing Indoor Carbon Monoxide Level	Laboratory of the Faculty of Health Sciences, Universitas Islam Lamongan	Two room samples	This study was a true experimental research using a pretest–posttest observation design.	The results of this study indicate that the extract of snake plant (Sansevieria trifasciata) and lemongrass (Cymbopogon citratus) subjected to 48 hours of oven-drying was more effective in absorbing indoor carbon monoxide caused by cigarette smoke compared to the extract dried for 24 hours. [13]

Literature review results from six selected articles indicate that Sansevieria trifasciata possesses significant potential as a biological agent for reducing indoor air pollution. The main differences among the studies lie in the forms of extracts used (fresh extract, ethanol extract, chloroform extract), pollutant parameters measured (e.g., CO, VOCs, formaldehyde), and testing methods employed (in vivo, in vitro, experimental in closed chambers). For instance, study P1 using fresh extract demonstrated a relatively high CO reduction, though it was less effective than P2, which used ethanol extract to reduce VOC levels. These differences may be influenced by solvent polarity and the solvent's ability to extract specific active compounds. Ethanol tends to extract phenolic compounds and flavonoids more effectively than water, resulting in higher antioxidant and anti-pollution activity [17,18]

Further review of the data table shows that the effectiveness of Sansevieria is closely related to its secondary metabolite content, such as saponins, flavonoids, triterpenoids, and phenolics. Saponins present in the leaf extracts have proven effective in reducing CO levels, as shown in P3 where CO reduction exceeded 70% in a closed room filled with cigarette smoke[18]. Flavonoids and phenolics also act as antioxidants capable of neutralizing free radicals and other oxidizing compounds in polluted air. Study P4 noted that phenolic compounds extracted with ethanol enhanced formaldehyde absorption capacity more than other studies using non-polar solvents[21].

Additionally, triterpenoids reported in P5 exhibit dual roles as anti-inflammatory agents and epigenetic compounds, which play an important part in regulating the body's response to air pollution stress[19]. Alkaloids and flavonoids in Sansevieria extracts also contribute to protective effects against cigarette smoke exposure, as demonstrated in P6, which measured oxidative stress biomarkers such as malondialdehyde (MDA) levels and alveolar macrophage counts in animal models. [22-24]

The plant's mechanism of action is also unique. Sansevieria absorbs pollutants through its stomata and breaks down compounds like carbon monoxide into CO and O ions, then metabolizes them into harmless organic compounds[25]. Studies P2 and P5 further indicate that absorption capacity increases with plant age and leaf number, with P5 reporting that five leaves can absorb up to 84.18% of carbon monoxide in a standard-sized indoor environment [6]. This effectiveness makes Sansevieria superior to other tested household plants under similar conditions.

However, this review has several limitations that must be acknowledged. First, the literature review includes only six articles meeting inclusion criteria, limiting the generalizability of the findings. Second, not all studies employed uniform standard testing methods, complicating quantitative synthesis and comparison. Third, quality assessments were conducted manually without systematic tools such as PRISMA or CASP, introducing potential selection and interpretation biases. Furthermore, some articles lacked complete numerical data on statistical tests or quantitative effectiveness, necessitating reliance on descriptive data.

Nonetheless, this review strengthens the position of Sansevieria trifasciata as a promising candidate for developing plant-based anti-pollution products, whether as passive filtration or extract formulations. The plant's environmental adaptability, ease of cultivation, and active phytochemical content make it a cost-effective, natural, and practical solution for improving indoor air quality.

CONCLUSIONS AND RECOMMENDATIONS

Based on the literature review of six selected articles, Sansevieria trifasciata has been proven to have significant effectiveness in reducing indoor air pollution levels, particularly carbon monoxide (CO). One analyzed study reported that this plant was capable of reducing CO concentrations by up to 84.18%. [6] The active compounds contained within, such as saponins, flavonoids, triterpenoids, phenols, and alkaloids, play an important role in the phytochemical activities that exhibit antioxidant, anti-pollutant, and detoxification properties in polluted air. The plant also has the ability to absorb various pollutants through leaf stomata and convert

them into safer organic compounds through metabolic processes. These findings reinforce the potential of Sansevieria trifasciata as a natural, effective, and affordable solution for improving indoor air quality.

Practically, this plant can be utilized in various enclosed spaces such as homes, offices, schools, or other public facilities as a passive filtration tool against air pollution, especially in environments with limited air circulation. Nonetheless, this review has several limitations, including the limited number of articles reviewed, variation in research methodologies among studies, and the absence of large-scale international studies within the sample. Therefore, further experimental research is needed to directly test the effectiveness of this plant under various real environmental conditions, as well as exploration of other anti-pollution plant species for comparison. Additionally, product formulation testing based on Sansevieria extracts could serve as a promising applied research direction for developing green environmental technologies in the future.

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