SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

EVALUATION OF PHYSICO-CHEMICAL PARAMETERS AND SCREENING OF TRACE ELEMENTS OF SIDDHA MEDICINE, *SIVANAR AMIRTHAM*

Allen Smith. J [1], Anandhi. D[1, 2], Revathi. K[1*], Aarthi. V[3], Jayanthi [4], Senthilkumari[5]
[1]Central Research Laboratory, Meenakshi Academy of Higher Education and Research (MAHER), Chennai-600 078.
[2]Meenakshi Ammal Dental College (MADC), Maduravoyal, Chennai – 600 095.
[3]Siddha Central Research Institute, Chennai-600 106.
[4]Department of zoology Arignar Anna govt.arts college for women walajapet - 632 513
[5] Assistant professor, Head of department of zoology, Chellammal College
***Corresponding Author**: Professor and Former Director of Research, MAHER University, Chennai – 600078, Tamil Nadu, India.

ABSTRACT

Siddha medicine, which is popularly known as Dravidian or Tamil Medicine, harbours variety of medications in treating several diseases, effectively. Ancient Siddhar scriptures have helped in the formulations of these medicines. *Sivanar amirtham* is one such mercuric colloidal medicine, which is effective in treating various types of respiratory diseases and also proven as an effective anti-microbial agent. In this study, physico-chemical properties were determined along with screening of trace elements of *Sivanar amirtham*. The Physico-chemical parameters analyzed for this medicine revealed 0.57% LOD, 8.46% Total ash content, 22.37% alcohol soluble extractive, 11.37% water soluble extractive and 7.56 pH. Steroid, triterpene, phenol, sugar and protein were the phytochemical and organic constituents present in *Sivanar amirtham.* Several trace elements were also analysed and concluded that mercury is one of the dominant trace elements among other element. Therefore, this study provides a clear insight on the physico-chemical parameters and trace elements of the siddha medicine, *Sivanar amirtham.*

Key words: Colloidal mercury, Phytochemicals, Siddha medicine, *Sivanar amirtham*

1. Introduction:

Siddha is considered to be one of the ancient medicinal practices in India, as it adopts ancient medicinal scriptures for formulation of medicines. Siddhars are eminent scholars who formulated the siddha medicines, in such a way that it finds suitability for all body types. Generally, human body types are distinguished as Vatham, Pitham and Kapham, and therefore, any disturbances in these systems could lead to several diseases. Recreating this equilibrium with the help of several medicines and medicinal practices, greatly help in permanent cure from diseases. Alchemy of several herbs and minerals is used in formulation of siddha medicines (Shukla *et al.,*2011). Siddha was typically originated from Tamil Nadu and still in practice, therefore it is also called as Tamil medicine (Sadhasivampillai *et al.,* 2018). Unlike allopathic medicines, siddha medicines have shown to possess lesser or no side effects after treatment or consumption of medicines. Siddha and ayurvedic medicines practice and encourage use of

SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

some metals such as mercury, gold, tin, copper etc., for treating diseases along with some herbs (Mukhi *et al.,* 2017). Several ayurvedic and siddha medicines incorporate mercury for formulation of medicines such as *Rasasindhur* (Mukhi *et al.,* 2017; Kamath *et al.,* 2012)*, Sidh Makardhwaj* (Kumar *et al.,* 2012)*, Linga chendhooram* (Arunachalam, 2015)*, Kajjali, Sivanar amirtham* (Malarvizhi *et al.,* 2020) etc., This herbo-mineral combination helps in effective treatment of diseases and found to possess no toxic side effects or bioaccumulation.

In such category, a siddha medicine *Sivanar amirtham* (herbo-mineral medicine) containing mercury help in treating different types of respiratory diseases (*Swasa noi*) and also act as potent anti-bacterial agent (Rajalakshmi, 2016). This medicine also proved to be potent anti-HIV activity and effective antidote for several insect bites (Malarvizhi *et al.,*2020). Due to Minamita accident, there has been large opposition in usage of mercury in medicines which affected the composition of several siddha medicines. But research on these medicines revealed its safety and non-toxic property (Ravishankar and Shukla, 2007; Kadam, 2013; Arunachalam, 2015) and hence, strongly recommended its use as effective siddha medicine for all types of respiratory ailments and cancer (Kannan *et al.,* 2021). However, there is little or no work performed thus far in determining the physico-chemical parameters of *Sivanar amirtham* and its actual compositional values. This study is thus designed with an aim to evaluate the various physico-chemical parameters, such as pH, trace elements, anti-microbial activity etc., of the potent siddha medicine, *Sivanar amirtham*.

2. Materials and Methods

2.1. Material examined:

Sivanar amirtham (colloidal mercuric siddha medicine) was brought from Central council for Research in Siddha, Chennai, and used for present study.

2.2. Physico-chemical parameters:

2.2.1.Loss on drying

This was based on thermogravimetric principle where *Sivanar amirtham* was dried completely using hot air oven without leaving any moisture content. Final (w_2) and initial (w_1) weight was noted and used for calculating LOD.

$$LOD\ (\%) = W1\text{-}W2/W1 \times 100$$

2.2.2.Total Ash

Appropriate amount of tared Porcelain crucible was weighed out along with sample (W1). Crucible along with sample was placed in muffle furnace at 760°C ± 20°C at one and half hour. The sample was re-cooled and the process was repeated until the constant weight (W2) was achieved. In this method total ash content was obtained.

Total ash = W2/W1 x 100

2.2.3. Water soluble ash

In this method, total ash was diluted in distilled water and heated to obtain a solution and this solution was filtered and dried. In this way water soluble ash value was obtained.

2.2.4. Acid insoluble ash

In this method, total ash (W3) was diluted in dilute hydrochloric acid (W1) and heated to obtain

SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774
a solution and this solution was filtered and dried (W2). In this way acid insoluble ash value was obtained.

Acid insoluble ash = W1-W2/W3 x 100

2.2.5. Alcohol soluble extractive

Solution containing 25ml of 95% absolute alcohol and 4g of sample was mixed thoroughly and was left overnight. Later the filtrate was filtered out and was dried in hot air oven. This dried filtrate was then weighed.

2.2.6. Water soluble extractive

Solution containing 25ml of distilled water and 4g of sample was mixed thoroughly and was left overnight. Later the filtrate was filtered out and was dried in hot air oven. This dried filtrate was then weighed.

2.2.7. pH determination

pH was determined using calibrated pH meter and obtained the value.

2.2.8. Estimation of phytochemicals

Phytochemicals were isolated, extracted and identified from *Sivanar amirtham* by following Velavan, 2015 method.

2.2.9. Estimation of trace elements

Trace elements in *Sivanar amirtham* was determined by using Agilent ICP-OES 5100 VDV instrument. In this experiment, 1ml of ultrapure nitric acid and 20mg of *Sivanar amirtham* was digested in Anton paar microwave digestion unit and about 50ml of sample was taken in measuring flask. The calibration standard solution was prepared for 0.2 µg/mL to 4 µg/mL and 0.1 µg/mL to 10 µg/mLfor mercury by using ultrapure nitric acid and blank also. The samples were then introduced into plasma using nebulizer and spray chamber for analysis.

3. **Results and Discussion**

Different physico-chemical parameters were analysed for *Siavanar amirtham* and obtained its mean values. Loss on drying value was 0.57% which was comparatively less compared to other siddha as well as ayurvedic medicines ranging from 4-13% (Kondalkar *et al.,* 2018). Loss on drying help in determining the actual water and volatile component in the sample and *Sivanar amirtham* contains relatively less water content compared to other siddha medicine like chitramutti kudineer (5.37%) (Rithambaradevi *et al.,* 2018).

Total ash content help in determining the total inorganic or mineral content of the sample. In this analysis, total ash content was estimated to be 8.46% which is similar to other siddha medicines such as Panchamuga chenduram (9.85%) (Muralidass *et al.,* 2018) and chitramutti kudineer (4.32%) (Rithambaradevi *et al.,*2018). This indicates the presence of submissible amount of mineral content in this siddha medicine. Water soluble ash and acid insoluble ash content of *Sivanar amirtham* was found to be 5.91% and 3.82% respectively. This content helps in determining the quality of sample (Table1 - 3).

Water soluble and alcohol extractive of the component help in determining the purity or adulteration of the sample. Less adulterated sample possess high water soluble and alcohol soluble extractive value (Chandel *et al.,* 2011) and *Sivanar amirtham* possess relatively high water soluble value 11.37% and alcohol soluble extractive value 22.37% compared to other

SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

siddha medicines and formulation ranging between 10- 15% for water soluble extractive and 9-32%for alcohol soluble extractive values (Chandel *et al.,* 2018; Rithambaradevi *et al.,*2018). This indicate that *Sivanar amirtham* possess less or no adulteration in components and also in purification method.

pH of the sample indicates its acidic or basic nature and this medicine possess pH value 7.56 which is near neutral. Hence it does not contain any acidic or basic properties which alter the blood composition or metabolism. Phytochemical composition helps in determining the presence various phytochemicals in that sample. Steroid, triterpene, phenol, sugar and protein were the phytochemical and organic constituents present in *Sivanar amirtham* (Figure 1-6). *Sivanar amirtham* is a herbo-mineral composition containing some minerals in trace amounts. Determination of trace elements amount in this sample helps in evaluating its bio-toxicity level and its usage as medicine. Values of trace elements were presented in table 2. This medicine being colloidal mercuric formulation has relatively but permissible amount of mercury in its composition 6.61 %. Unlike western medicine, siddha medicine proved mercury as potent therapeutic agent and its proper usage in medicine (Kamath *et al.,* 2012). Even WHO promote the usage of ancient religious medicines as alternative and effective medicines in treating several diseases (Karunamoorthi *et al.,* 2012). But it doubts the biotoxicity accumulation of certain metals such as mercury, zinc etc, in traditional medicines. Due to this reason, siddha medicine encourages and practices purification of ingredients before incorporating in the medicines (Shukla *et al.,* 2011).

Sivanar amirtham is found to be highly efficient, non-toxic herbo-mineral formulation which help in treating several respiratory diseases and this study reveal its physico-chemical properties. Composition of trace elements in this medicine is in appropriate amount as an effective siddha medication.

Conclusion

Siddha medicine, being recognized as an Indian Traditional medicine, has received utmost target of attraction, due to its valuable biological and pharmacological properties as well as its profound ability to control the Pancha Bhutas. Due to the existence of a strong inter-relationship between the external (macrocosm) and internal (microcosm) of humans, the Siddha medicine acts as a suitable medicinal therapy for various ailments. The present study is one such attempt to evaluate the physico-chemical parameters of the Siddha medicine, *Sivanar amirtham,* which would greatly help in the exploration of the active principle behind its beneficial effects.

Acknowledgement

The Authors are grateful to the Management of Meenakshi Academy of Higher Education and Research (MAHER), Chennai.

Conflict of Interest

The Authors declare that there is no conflict of Interest.

SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

REFERENCES

Arunachalam J. (2015). Researches on mercurial preparations: The prime requirement for their acceptance in medical world. *Ayu*, *36*(2), 118–124. https://doi.org/10.4103/0974-8520.175541.

Avinash Kondalkar , Sapna Avinash Kondalkar , Vijay Kumar , Anupam K. Mangal and V. Subhose (2018) Effect of Proportion Composition Variation On Physicochemical Parameters of Triphala*IJPSR*, Vol. 9(10): 4280-4285.

Chandel, H. S., Pathak, A. K., & Tailang, M. (2011). Standardization of some herbal antidiabetic drugs in polyherbal formulation. *Pharmacognosy research*, *3*(1), 49.

G. Ridhambaradevi , M. Meenakshi Sundaram , A. M. Amala Hazel and V. Banumathi (2018) Physiochemical, Phytochemical, Bio-Chemical Analysis of Neuro Protective Traditional Siddha Medicine Chitramutti Kudineer*World Journal of Pharmaceutical Research* Vol 7, Issue 18; 1195-1208.

Kadam, Avinash. (2013). Mercury in Ayurveda : A Poison Turned Nectar.*Rasamruta.*(5).

Kaliyaperumal, Karunamoorthi & Jegajeevanram, Kaliyaperumal & X, Jerome & Vijayalakshmi, Jayaraman & Melita, Luke. (2012). Tamil Traditional Medicinal System – Siddha: An Indigenous Health Practice in the International Perspectives. *International Journal of Genuine Traditional Medicine (TANG).* 2. 1-11. 10.5667/tang.2012.0006.

Kamath, S. U., Pemiah, B., Sekar, R. K., Krishnaswamy, S., Sethuraman, S., & Krishnan, U. M. (2012). Mercury-based traditional herbo-metallic preparations: a toxicological perspective. *Archives of toxicology*, *86*(6), 831-838.

Kannan. N,, S SS, S B, Nv AK, N B. (2021)Physiochemical characterization and toxicity assessment of colloidal mercuric formulation-'Sivanar amirtham'. *Colloids Surf B Biointerfaces.* Apr;200:111607. doi: 10.1016/j.colsurfb.2021.111607. Epub 2021 Feb 3. PMID: 33578085.

Kumar, G., Srivastava, A., Sharma, S. K., & Gupta, Y. K. (2014). Safety evaluation of mercury based Ayurvedic formulation (Sidh Makardhwaj) on brain cerebrum, liver & kidney in rats. *The Indian journal of medical research*, *139*(4), 610–618.

Kumar, S., Dobos, G. J., & Rampp, T. (2017). The Significance of Ayurvedic Medicinal Plants. *Journal of evidence-based complementary & alternative medicine*, *22*(3), 494–501. https://doi.org/10.1177/2156587216671392.

Malarvizhi , Fang , Luo RH , Zheng YT , Vedha Hari BN , Ramyadevi D (2020)Repurposing of Nano-Herbomineral Formulation for Anti-HIV Activity*Abstracts from the International*

DOI: 10.5281/zenodo.7221774

Science Symposium on HIV and Infectious Diseases (ISSHID 2019): Proceedings. BMC Proceedings, 14(S7), –. doi:10.1186/s12919-020-00190-4.

Mukhi, P., Mohapatra, S. S., Bhattacharjee, M., Ray, K. K., Muraleedharan, T. S., Arun, A., Sathyavathi, R., Juluri, R. R., Satyam, P. V., Panda, A. K., Biswas, A., Nayak, S., Bojja, S., Pratihar, S., & Roy, S. (2017). Mercury based drug in ancient India: The red sulfide of mercury in nanoscale. *Journal of Ayurveda and integrative medicine*, *8*(2), 93–98. https://doi.org/10.1016/j.jaim.2017.01.009.

Muralidass, S D & Devi M S, Shree. (2020). Physicochemical characterization of the Siddha herbo-mineral drug - Panchamuga chenduram. *Journal of Pharmacy Research*. 12. 936-938.

Rajalakshmi, K. (2016). Screening of common siddha formulations for antimicrobial activity against respiratory pathogens. *Screening*, *9*(2).
Ravishankar, B., & Shukla, V. J. (2007). Indian systems of medicine: a brief profile. *African journal of traditional, complementary, and alternative medicines : AJTCAM*, *4*(3), 319–337. https://doi.org/10.4314/ajtcam.v4i3.31226.

Saraf, Shailendra & Shukla, Shiv Shankar. (2011). Fundamental aspect and basic concept of siddha medicines. *Systematic Reviews in Pharmacy*. 2. 48. 10.4103/0975-8453.83439.

Sathasivampillai, S. V., Rajamanoharan, P. R., & Heinrich, M. (2018). Siddha Medicine in Eastern Sri Lanka today–Continuity and change in the treatment of diabetes. *Frontiers in pharmacology*, *9*, 1022.

Shukla SS, Saraf S, Saraf S (2011) Fundamental Aspect and Basic Concept of Siddha Medicines. *Systematic Reviews in Pharmacy*, 2 (1), 48-54. doi:10.4103/0975-8453.83439.

Velavan, S. (2015). Phytochemical techniques-a review. *World Journal of Science and Research*, *1*(2), 80-91.

SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

Tables

Table 1: Physico chemical composition of *Sivanar amirtham*

S.No	Parameter	Mean value
1.	Loss on drying	0.57 %
2.	Total Ash	8.46 %
3.	Water soluble ash	5.91 %
4.	Acid insoluble ash	3.82%
5.	Alcohol soluble extractive	22.37 %
6.	Water soluble extractive	11.37%
7.	pH	7.56

Table 2: Estimation of phytochemical parameters

S.No	Phytochemical compounds	Activity
1.	Steroid	+
2.	Triterpene	+
3.	Phenol	+
4.	Flavonoids	-
5.	Sugar	+
6.	Saponin	-
7.	Protein	+
8.	Coumarin	-
9.	Quinone	-
10.	Anthraquinone	-

Table 3: Estimation of trace elements in *Sivanar amirtham*

S.No	Trace elements detected	Mean value
1.	Aluminium	310.43 µg/g
2.	Barium	44.8µg/g
3.	Cadmium	1.865 µg/g
4.	Copper	18.61 µg/g
5.	Molybdenum	70.225 µg/g
6.	Lead	5.88 µg/g
7.	Strontium	40.075 µg/g
8.	Zinc	55.59 µg/g
9.	Arsenic	4.26%
10.	Calcium	0.21%
11.	Potassium	1.225%
12.	Manganese	1.22%

SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

13.	Sodium	0.85%
14.	Mercury (184.88)	6.61%
15.	Mercury (194.16)	6.59%

Figures

Figure 1: Physico chemical factors of *Sivanar amirtham*

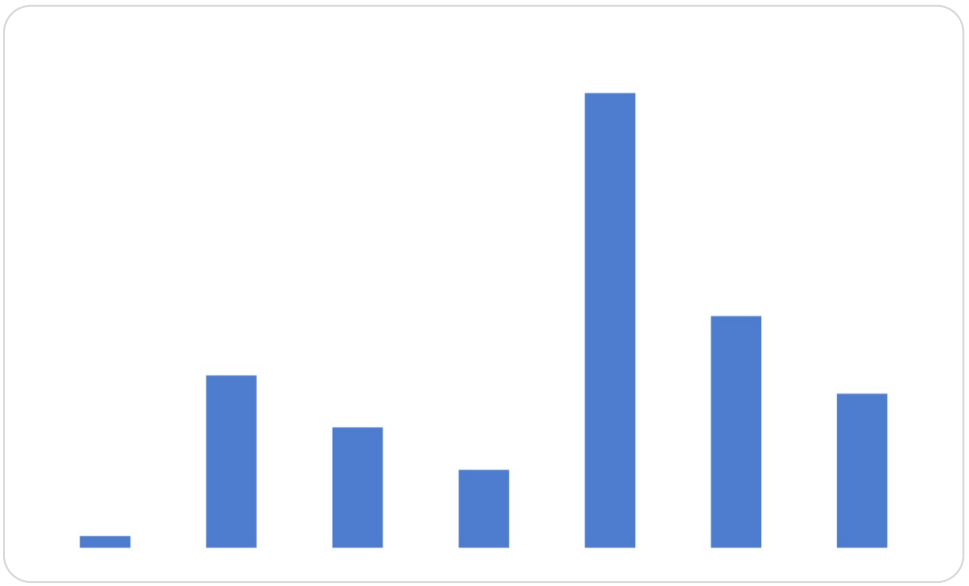
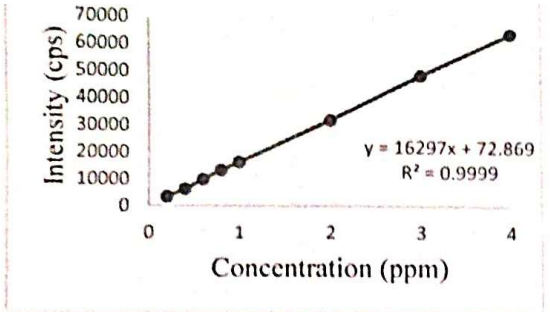
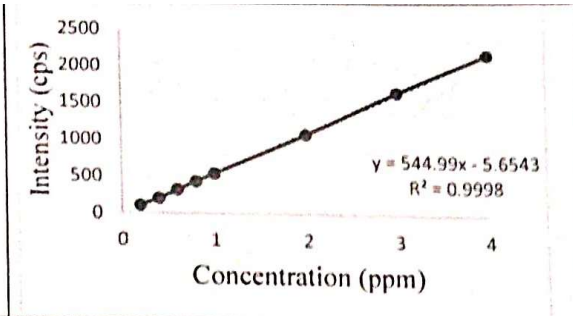


Figure 2. Screening of trace elements of *Sivanar amirtham*

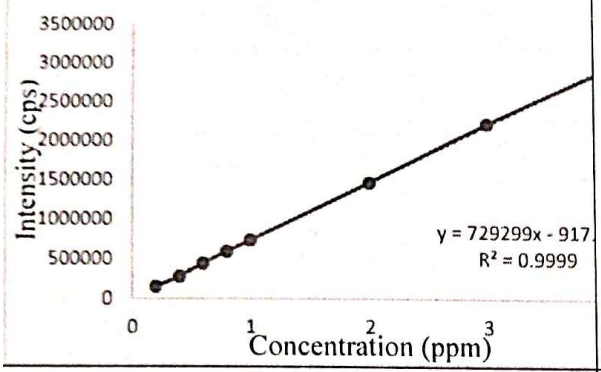
SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774



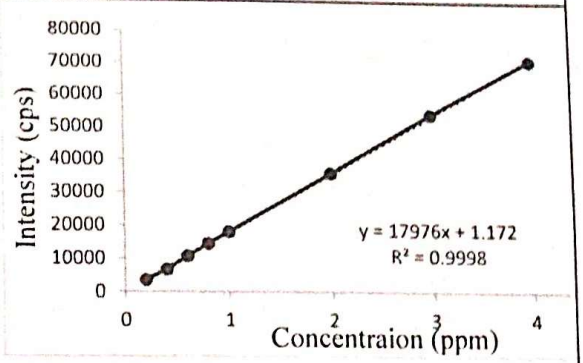
Aluminium



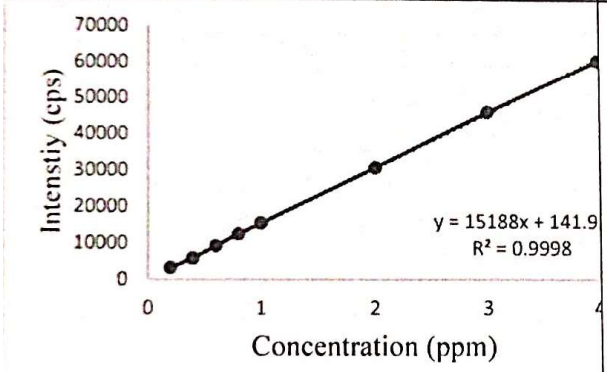
Arsenic



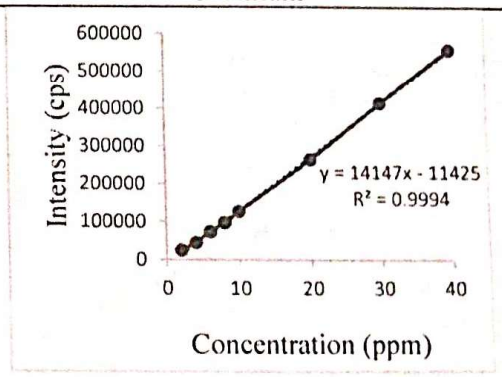
Barium



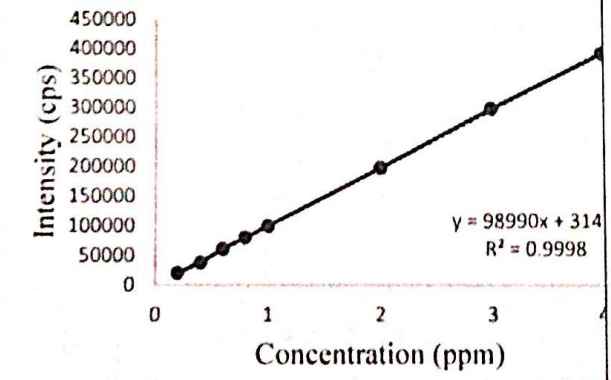
Cadmium



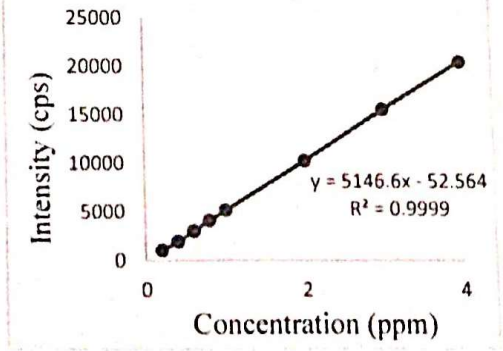
Copper



Potassium



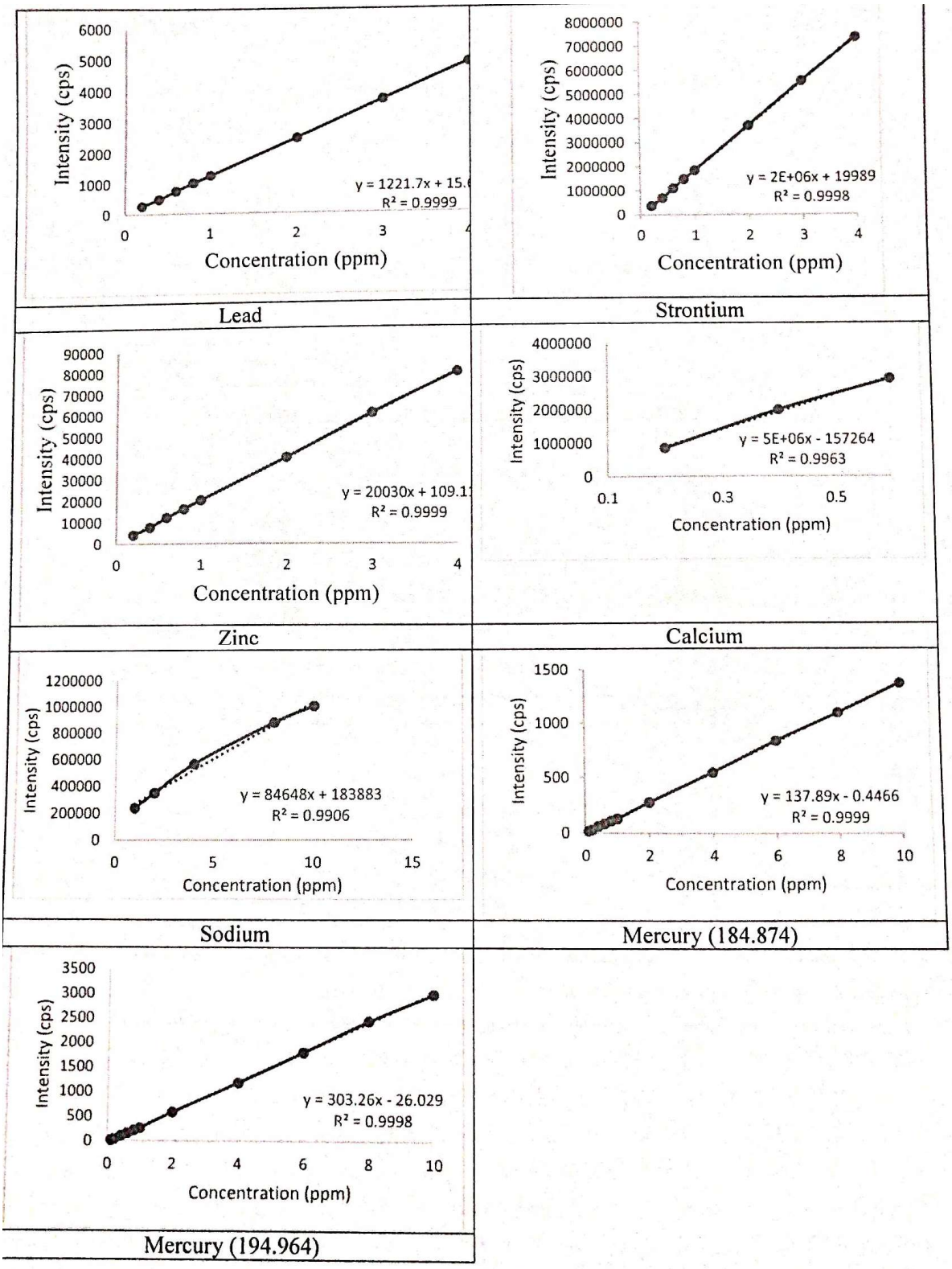
Manganese



Molybdenum

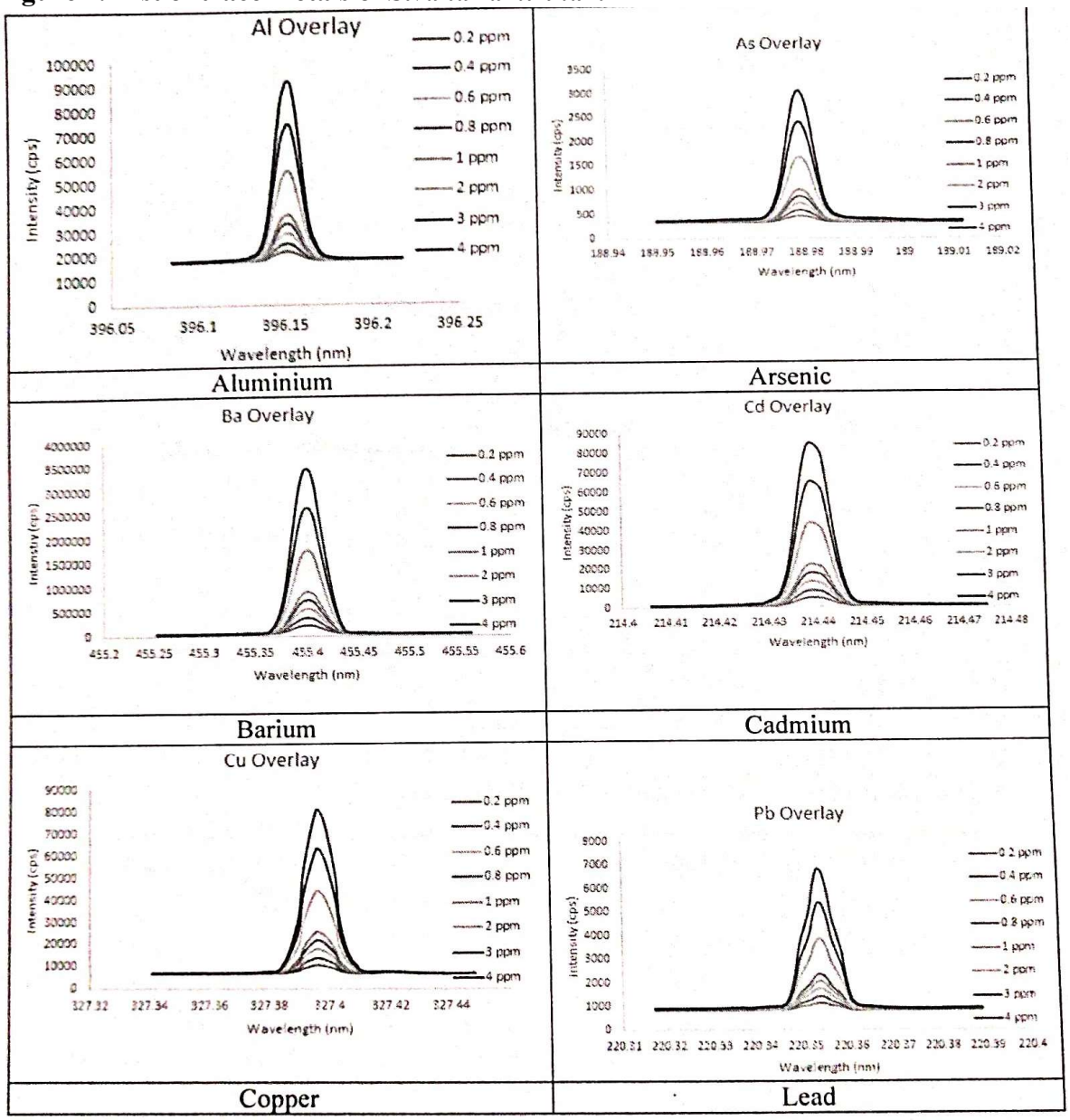
SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

Figure 3. Trace metal analysis of *Sivanar amirtham*



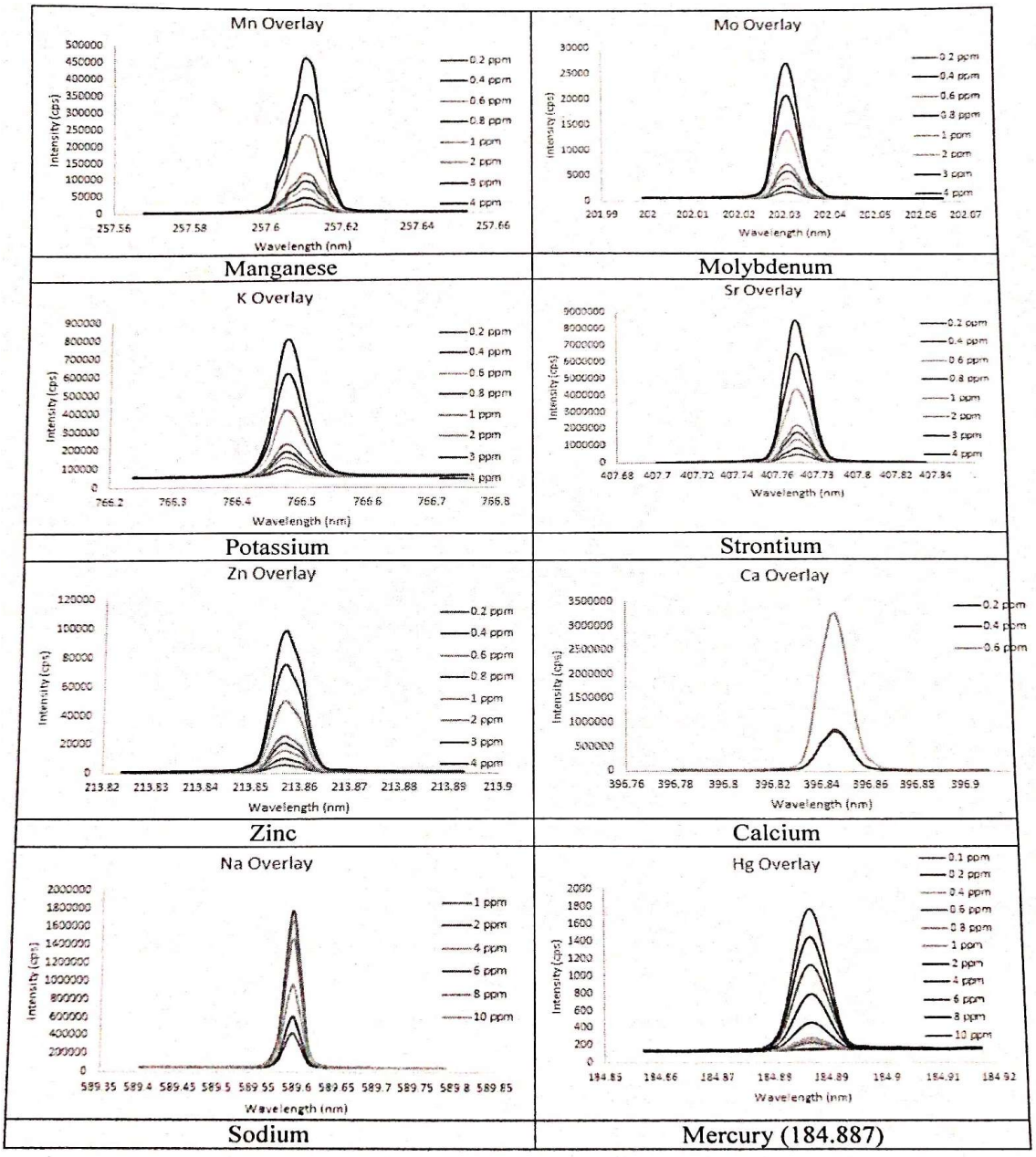
SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

Figure 4. List of trace metals of *Sivanar amirtham*



SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

Figure 5. Trace metal analysis of *Sivanar amirtham*



SEYBOLD Report
ISSN: 1533 - 9211
DOI: 10.5281/zenodo.7221774

Figure 6. Evaluation of the level of Mercury in *Sivanar amirtham*