

THE COMPOUNDING OF CINNABAR (RED MERCURY(II) SULFIDE) IN THE PERSIAN POETRY OF THE ELEVENTH CENTURY

Aliyar Mousavi, Math & Sciences Department, Nashua Community College,
505 Amherst Street, Nashua, NH 03063, USA, amousavi@ccsnh.edu

Abstract

A study of Persian poetry in the tenth and eleventh centuries, when it had just been revived after three centuries of neglect under Arab rule, reveals a frequent repetition of the word “cinnabar” [Persian (Farsi) *shangarf*], now known as HgS (mercury(II) sulfide). It is especially noteworthy that certain poems in the eleventh century described cinnabar from a synthetic perspective, including one poem (by Naser-e Khusraw) that qualitatively described the compounding of cinnabar accurately, including naming mercury and sulfur in a way nearly identical to the standard wording used today. The origin of the chemical idea reflected in the poem is investigated and attributed to an account of the preparation of cinnabar, by heating elemental mercury and elemental sulfur together, given by the Persian Muhammad al-Razi, also known in Europe as Rhazes.

Dedication

Dedicated to the memory of my father, Seyed Masoud Mousavi, who introduced me to *Shahnameh* (“Book of Kings”), the Iranian national epic, when I was a young child.

In the autumn of 633, about one year after the death of the Prophet Muhammad and at the conclusion of the wars during which the Muslim Arabs conquered Arabia, they marched northward and began operations in Syria. This was the beginning of an approximately

twenty-year period during which not only the Byzantine lands of Syria and Egypt, as well as North Africa, but also the Sasanid Persian empire fell to Arab hands (1). It was in June 637 when the Arab commander Sa’d ibn-abi-Waqqas entered the Persian capital, Ctesiphon, and the death of the Sasanid Yazdagird III in 651 was the end of the last ruler of an empire that had flourished, with only one interruption (caused by Alexander the Great), for approximately twelve centuries (1).

In the following three centuries of Arab rule, Arabic became not only the official language but also the speech of the cultured society of Persia (1). A natural consequence of the Persian (Farsi) (2) language being neither an official language nor a speech of the cultured society of Persia was the decline of Persian literature; however, in the words of Philip Hitti (1), “the old spirit of the subject nation was to rise again and restore its neglected tongue.” The first highly noteworthy poet in Muslim Persia who composed poems in Persian was Rudaki, who lived in the second half of the ninth century and first half of the tenth century; optimism, charm, and later melancholy are words that have been applied to his poetry (3). Still, poetry in Muslim Persia was not to rise fully until the second half of the tenth century, when the Persian poet Ferdowsi composed the *Shahnameh* (“Book of Kings”), the epic of the kings of pre-Islamic Persia (4).

In the stories of the *Shahnameh*, Ferdowsi repeatedly mentions a certain ore that was widely used as the

red pigment vermilion in the ancient world: cinnabar [Persian *shangarf*], which we know as HgS (mercury(II) sulfide) (5). In general, Ferdowsi does that in metaphorical references to the blood shed in battles by the warriors in his stories. An example follows (“cinnabar water” metaphorically meaning “blood”) (6):

پَر از ناله کوس شد مهر و میغ

پَر از آب شنگرف شد جان تیغ

The Sun and the clouds became full of drum sounds;

The sword bodies became full of cinnabar water.

The presence of the word “cinnabar” in Persian poetry becomes especially attractive to historians of chemistry when the Persian poems of the eleventh century are searched for it. Interestingly enough, a relatively unknown Persian poet of the eleventh century, named Azraqi Heravi, at whose father’s house Ferdowsi had lived for six months (7), gives the following direct reference to how cinnabar and elemental mercury (Hg), also called quicksilver, are related to each other (8):

شگفت نیست گر از برف لاله ساخت زمین

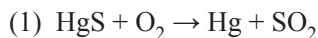
که هست لاله چو شنگرف و برف چون سیماب

No wonder if the earth makes tulips from snow,

For tulips are like cinnabar, and snow is like quicksilver.

The Persian word for quicksilver in this poem is *simab*, which literally means “silvery water” (somehow similar to the Latin word for mercury, *hydrargyrum*, which literally means “liquid silver” (5)).

The main use of quicksilver in the eleventh century, as well as many centuries before and after that, was the extraction of gold and, especially, silver by amalgamation. The process of extracting quicksilver from cinnabar (the only important ore of mercury) has been basically the same since ancient times (9): roasting cinnabar in a current of air (Equation 1) and condensing the produced vapor (5).



The poet, however, does not say that quicksilver can be made from cinnabar. He rather says that cinnabar can be made from quicksilver. Why would he think so? A reasonable answer would be that his knowledge that quicksilver was extracted from cinnabar led him to believe that quicksilver could be used to make cinnabar. Still, further poetic evidence from the same century

shows that this answer might be too simplistic to be the whole truth or even true.

One of the most noteworthy writers in Persian literature, who is nearly as famous as Ferdowsi and certainly not less known than Rudaki is Naser-e Khusraw, not only another poet, but also a theologian and religious propagandist of the eleventh century (10). In the writings of Naser-e Khusraw, the following poetic question, apparently referring to God (arguing for the existence of God by trying to show that the universe is a work of a powerful intelligent designer), would be intriguing to historians of chemistry (8):

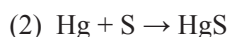
که بود آنکه او ساخت شنگرف رومی

ز گوگرد سرخ و ز سیماب لرزان

Who was the one who made Byzantine cinnabar,

From red sulfur and from shaking quicksilver?

Burke et al. (11) note the existence of the numerous mercury mines, which contain cinnabar, in present-day western Turkey and show how present-day Turkey is made of what used to be the Byzantine mainland. Therefore, the term “Byzantine cinnabar” is explained. Also, when elemental sulfur at room temperature (α -S₈, which is yellow (5)) melts, the molten sulfur is a yellow to red liquid (12). Further, Greenwood and Earnshaw (5) acknowledge that cinnabar (red HgS) “can be prepared from the elements.” The reaction may be shown by Equation 2:



Still, the main question is how Naser-e Khusraw, who lived about one thousand years ago, was able to qualitatively describe the compounding of cinnabar accurately, including naming mercury and sulfur in a way nearly identical to the standard wording used today. If there are reasons to believe that the reaction shown by Equation 2 had ever been carried out sometime before Naser-e Khusraw indirectly stated (in his poem) that cinnabar is a mercury-sulfur combination and that he was aware of that synthesis, then it is entirely predictable that he would think as his poem says. Are there such reasons?

In the second half of the ninth century and first half of the tenth century, around when Rudaki was reviving poetry in Persian in Muslim Persia, another Persian was making his name, in the words of Philip Hitti, “the greatest in the field of medieval chemical science:” Muhammad al-Razi, known in Europe as Rhazes (1). A thirteenth-century Latin translation of a part of Rhazes’s work entitled *Razis de aluminibus et salibus* contains “a

fairly clear account” of the preparation of cinnabar, by heating the two elements together (9). Parts of the account in English are addressed by Farrar and Williams as follows (9):

Another coagulation of mercury with the vapour of sulphur. There is another method, and it is the coagulation of [mercury] with the odour [vapour] of sulphur. ... Then you will find a red salt *uzifur* [Arabic *zanjufur* = cinnabar].

Naser-e Khusraw’s intellectual dimensions are several. In fact, as capable as he was as a poet, he may also be viewed as a learned ideological activist. He was not only a convert by joining the Isma’ili sect, headed by the Fatimid dynasty, but also a missionary sent by the Fatimids to propagate their beliefs throughout the Islamic world. Further, among his many writings is a treatise entitled *Jami’ al-hikmatayn* (“Union of the Two Wisdoms”), an attempt to harmonize Isma’ili theology and Greek philosophy (10). A person of such a high intellectual caliber in the eleventh century most probably encountered Arabic alchemical ideas, including alchemical accounts given by Rhazes. Philosophy was the central science at that time, and intellectual pursuits were not as specialized or compartmentalized as they are today. In fact, additional evidence for Naser-e Khusraw’s awareness of the details of Rhazes’s alchemical writings is that *Jami’ al-hikmatayn* (13) includes Naser-e Khusraw’s critical review of Rhazes’s philosophical ideas, with Rhazes named in the purely Persian form “Muhammad-e Zakariya Razi” several times. Naser-e Khusraw even mentions in *Jami’ al-hikmatayn* (13) that in order to refute a certain philosophical belief of Rhazes, he has spoken against him in a book entitled *Bustan al-‘uqul* (“Garden of the Reasons”).

If Naser-e Khusraw’s complete qualitative description of the compounding of cinnabar is due to his familiarity with Arabic alchemical writings, then it is possible that Azraqi Heravi’s poem saying that cinnabar is from quicksilver is also due to his exposure to Arabic alchemical ideas. This conclusion is all the more plausible because Azraqi Heravi’s father was a bookseller (7) and, according to the retired teacher of Persian literature Gholamreza Kashani (14), who started teaching in 1963, Persian booksellers, even until about the end of the twentieth century, often followed the tradition of reading the books that they sold. This means that Azraqi Heravi might have been exposed to Arabic alchemical ideas through his father. To what extent has poetry in Muslim Persia during its history been influenced by Arabic alchemy? The answer requires comprehensive research.

However, considering that both Naser-e Khusraw and Azraqi Heravi lived in the eleventh century, a focused study on the other Persian poets of the eleventh century would be a reasonable first step in the future.

Acknowledgments

Aliyar Mousavi would like to thank Mr Gholamreza Kashani, retired teacher of Persian literature, Ministry of Education, Islamic Republic of Iran, for providing the citation information for References 6 and 8. He would also like to thank Dr Nazila Farmani Anooshe, Editor-in-Chief, Allameh Tabataba’i University, Tehran, Islamic Republic of Iran, for her assistance concerning the Persian couplets in the article.

References and Notes

1. P. K. Hitti, *History of the Arabs*, St. Martin’s Press, New York, 1974.
2. The word Persian will be used throughout to denote the language in which the poetry discussed here was written. Today Persian is the English name for the descendants of the language, known by native speakers as Farsi in Iran, Dari in Afghanistan and Tajik in Tajikistan. See, for example, Penn Language Center, Persian, plc.sas.upenn.edu/persian (accessed 27 July 2021).
3. Britannica, “Rūdakī: Persian Poet,” www.britannica.com/biography/Rudaki (accessed 27 July 2021).
4. A. Ferdowsi (translated by D. Davis), *Shahnameh: The Persian Book of Kings*, Penguin, New York, 2016. Abridged English translations date back to 1832 (translation by J. Atkinson, published by J. Murray, London), available online at books.google.com/books?id=H8JVAAAaAAJ (accessed 27 July 2021).
5. N. N. Greenwood, A. Earnshaw, *Chemistry of the Elements*, Pergamon Press, Tarrytown, NY, 1994.
6. A. Joveini, *Abolghasim-i Ferdowsi’s Shahname Introduction and Annotation*, vol. 2 [in Persian], University of Tehran Press, Tehran, Iran, 1998/1999. Translation by the present author.
7. Dj. Khaleghi Motlagh, “Azraqī Heravī,” *Encyclopaedia Iranica*, www.iranicaonline.org/articles/azraqi-heravi (accessed 11 April 2021).
8. A. Dehkhoda, *Loghat-nameh* (Dictionary Encyclopedia) [in Persian], University Press, Tehran, Iran, 1958/1959. Translation by the present author.
9. W. V. Farrar and A. R. Williams, “A History of Mercury,” in C. A. McAuliffe, Ed., *The Chemistry of Mercury*, Macmillan, London, 1977, pp 1-45.

10. Britannica, "Nāṣer-e Khusraw: Persian Author," www.britannica.com/biography/Naser-e-Khusraw (accessed 11 April 2021).
11. N. Burke, M. Golas, C. L. Raafat and A. Mousavi, "A Forensic Hypothesis for the Mystery of al-Hasan's Death in the 7th Century: Mercury(I) Chloride Intoxication," *Med. Sci. Law*, **2016**, 56, 167-171.
12. National Oceanic and Atmospheric Administration (NOAA), Cameo Chemicals, "Sulfur, Molten," cameochemicals.noaa.gov/chemical/4562 (accessed 11 April 2021).
13. H. Corbin and M. Moin, *Naser-e Khusraw's Jami' al-hikmatayn* [in Persian], Tahouri Library, Tehran, Iran, 1984/1985.
14. G. Kashani, Personal Communication, 12 April 2021.

About the Author

Aliyar Mousavi completed his undergraduate studies at the University of Maryland at College Park in 1998 and did his graduate studies at Long Island University (Brooklyn Campus) and The University of New Mexico. He received his Ph.D. degree in Chemistry from The University of New Mexico in 2010. He has been a professor in chemistry and environmental science at Nashua Community College since 2011.

HIST to Celebrate 100th Birthday

The American Chemical Society (ACS) Division of the History of Chemistry (HIST) will celebrate its hundredth birthday as an ACS Division in 2022. Today, HIST has about 1,000 members from every sector of the ACS, mounts symposia regularly at ACS National Meetings and at many regional meetings, publishes two Newsletters per year, and since 1988 has published this journal, the *Bulletin for the History of Chemistry*. HIST's publishing record also includes 37 history-related volumes published over the course of the past 60 years that include topics in archaeological chemistry, biography, anniversaries of important chemical events, and history of chemical sub-disciplines.

Two major projects to celebrate its Centennial Year are currently in development:

1) The Centennial History of the Division of the History of Chemistry: A thorough treatment of what happened before, during the foundation, during its evolution and up to the present. The project will be open access and published online. Gary Patterson, Historian of HIST, is organizing the project. Further information, including a projected table of contents, can be found on the HIST website at acshist.scs.illinois.edu/centennial/index.php. Gary welcomes contributions: please send him written material, photographs, ephemera, etc. at gp9a@andrew.cmu.edu. You too can author a full or partial chapter!

2) The *Bulletin for the History of Chemistry* is preparing a special issue in honor of the centennial. Guest editor Jeffrey I. Seeman and Editor in Chief Carmen Giunta have obtained essays from several recipients of HIST's major awards and current leaders in the history of chemistry to write on the theme "Novel Insights in the History of Chemistry: Looking Back Yet Mostly Looking Forward." The issue will be open access to all online; HIST members will receive hard copies.