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ARTIGO

A BIBLIOGRAPHICAL STUDY ON THE IMPORTANCE OF PIGMENTS OBSERVED IN COLONIAL BRAZIL TIMES IN THE LIGHT OF THE HISTORICAL-DIALECTICAL MATERIALISM

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A BIBLIOGRAPHICAL STUDY ON THE IMPORTANCE OF PIGMENTS OBSERVED IN COLONIAL BRAZIL TIMES IN THE LIGHT OF THE HISTORICAL-DIALECTICAL MATERIALISM

ABSTRACT: Scientific research supported by historical accounts enables us to engage in our society's cultural and historical reality and build scientific knowledge. Scientific evolution has its complex dynamics, even in a country like Brazil, where the history of its scientific institutions is quite recent. Pero Vaz de Caminha's observations in the letter where he describes the just-found continent are important for the history of our country and the development of modern science. To this end, the general objective is to analyse the chemistry teaching through the theme "pigment extraction in colonial Brazil" by compiling dissertations and theses to investigate the fundamentals of the history and philosophy of sciences relating to alchemy and the history of chemistry in Brazil, and to deepen the studies on the extraction methods. The methodology adopted was the systematic literature review in 19 studies, ten masters' dissertations and nine doctoral theses, based on the state of the question, in the light of historical–dialectical materialism that enabled the perception and critical analysis of the insertion of the history of chemistry content. Through literature, this study analysed how the discussion of the history of chemistry and the history and philosophy of sciences is situated. In this movement, we understand the relationships between science and social totality by involving reports of historical moments, pigments and extraction methods, bringing science closer to real human life and its daily development

Keywords: History of chemistry, Pigments, Historical-dialectical materialism.

UM ESTUDO BIBLIOGRÁFICO SOBRE A IMPORTÂNCIA DOS PIGMENTOS OBSERVADOS NO BRASIL COLONIAL À LUZ DO MATERIALISMO HISTÓRICO-DIALÉTICO

RESUMO: A investigação científica apoiada em relatos históricos permite-nos participar na realidade cultural e histórica da nossa sociedade e construir conhecimento científico. A evolução científica tem sua dinâmica complexa, mesmo em um país como o Brasil, onde a história de suas instituições científicas é bastante recente. As observações de Pero Vaz de Caminha na carta que descreve o continente recém-

fundado são importantes para a história do nosso país e para o desenvolvimento da ciência moderna. Para tanto, o objetivo geral é analisar o ensino de química por meio do tema "extração de pigmentos no Brasil colonial" por meio da compilação de dissertações e teses para investigar os fundamentos da história e da filosofia das ciências relacionadas à alquimia e à história da química no país. Brasil, e aprofundar estudos sobre métodos de extração. La metodología adoptada fue la revisión sistemática de la literatura en 19 estudios, diez disertaciones de maestría y nueve tesis doctorales, con base en el estado de la cuestión, a la luz del materialismo histórico-dialéctico que permitió la percepción y análisis crítico de la inserción da historia. de conteúdo de química. Através da literatura, este estudo analisou como se situa a discussão da história da química e da história e filosofia da ciência. Neste movimento entendemos as relações entre ciência e totalidade social envolvendo histórias de momentos históricos, pigmentos e métodos de extração, aproximando a ciência da vida humana real e do seu desenvolvimento cotidiano.

Palavras-chave: Historia da química, Pigmentos, Materialismo histórico-dialético.

UN ESTUDIO BIBLIOGRÁFICO SOBRE LA IMPORTANCIA DE LOS PIGMENTOS OBSERVADOS EN EL BRASIL COLONIAL A LA LUZ DEL MATERIALISMO HISTÓRICO-DIALÉCTICO

RESUMEN: La investigación científica respaldada por relatos históricos nos permite participar en la realidad cultural e histórica de nuestra sociedad y construir conocimiento científico. La evolución científica tiene su dinámica compleja, incluso en un país como Brasil, donde la historia de sus instituciones científicas es bastante reciente. Las observaciones de Pero Vaz de Caminha en la carta donde describe el continente recién fundado son importantes para la historia de nuestro país y el desarrollo de la ciencia moderna. Para ello, el objetivo general es analizar la enseñanza de la química a través del tema "extracción de pigmentos en el Brasil colonial" mediante la recopilación de disertaciones y tesis para investigar los fundamentos de la historia y filosofía de las ciencias relacionadas con la alquimia y la historia de la química en Brasil, y profundizar los estudios sobre los métodos de extracción. La metodología adoptada fue la revisión sistemática de la literatura en 19 estudios, diez disertaciones de maestría y nueve tesis doctorales, con base en el estado de la cuestión, a la luz del materialismo histórico-dialéctico que permitió la percepción y análisis crítico de la inserción de la historia. de contenido de química. A través de la literatura, este estudio analizó cómo se sitúa la discusión de la historia de la química y la historia y filosofía de las ciencias. En este movimiento entendemos las relaciones entre ciencia y totalidad social al involucrar relatos de momentos históricos, pigmentos y métodos de extracción, acercando la ciencia a la vida humana real y su desarrollo cotidiano.

Palabras clave: Historia de la química, Pigmentos, Materialismo histórico-dialéctico.

INTRODUCTION

The experience of investigating science through historical reports makes us realise the involvement of realities immersed in cultural activities, establishing relationships between traditional scientific knowledge and academic research. The investigation of official documents allows us to acknowledge that science is present in our civilisations. We must revisit the history books and research about our civilisations that preached diversity and plurality, where everyone participated in the processes and had the techniques that were required for conscious survival.

Scientific evolution has its complex dynamics, even in a country like Brazil, where the history of its scientific institutions is recent. It is necessary to know its origins , understand its contributions to knowledge and social development, and make plans for the future. The native contribution to the constitution of the sciences has long been undervalued. The researcher's role is to disseminate the results

of the project's proposals and collaborate with scientific enrichment. The learning processes are effective when based on the students' reality, understanding their culture and the concepts that guide their model of society, acting critically to disclose information.

We have observed that several relevant issues for popular education have been overlooked in Brazil's academic productions, such as research on indigenous peoples and pigment extraction techniques in national basic education and references to the history of chemistry. The absence of such works makes us question how our pedagogical action has been thought, planned, and executed. Our objective is to reveal the situation of this research in Brazil

THEORETICAL FRAMEWORK

The principles of alchemy

Starting from primary concepts and ideas, discussions about scientific discoveries have been developed to achieve more elaborate and relevant proposals and formulations for scientific and technological advancement in society. According to Martins (2006, p.18), "our knowledge was slowly being formed, through contributions from many people we have not even heard about and who played an important role in the discussion and improvement of the ideas of the most famous scientists." The studies of those renowned scientists were not based on ready-made methods because the ideas were not concrete. They were designed for the observations and experiments environment, which reformulate the initial thoughts and refute them to have them structured.

Science is done among the people, in the construction of a society, in history, culture, and materiality. When we can observe it through well-formulated and structured foundations, we perceive the positive view of those events due to the relevance of studies and actions. The execution of scientific work favours the awakening of youth to research in natural science, where interweaving with the history of the development of the area may occur.

Chemical knowledge is indispensable to understand part of the dynamism of our planet, collaborating with the social construction of the individuals involved. To continue in the processes of transformations with this purpose, the history of chemistry offers the possibility to understand the process of knowledge production from the advances, conflicts, and errors that reach concepts widely used in scientific society.

> Science must be perceived as a creation of the human intellect and, like any human activity, also subjected to evaluations of an ethical nature. The knowledge disseminated in the teaching of chemistry allows the construction of a more articulated and less fragmented worldview, contributing to the individual's view as a participant in a world in constant transformation. For this, this knowledge must be translated into cognitive and affective competencies and skills. Cognitive and affective, so that they can be considered competencies in their fullness. Acquisition of knowledge, more than simple memorisation, presupposes logical-empirical and logical-formal cognitive skills. (Brasil, 2000, p. 32)

Something noticeable in most teachers is the use of reports of past experiences they contextualise in some classroom situation. And why not include the historical approach in teaching chemistry to broaden students' and teachers' knowledge?

Scientific knowledge comes from a nature that is based on hypotheses, in which observation is done through experiments that form the rational arguments that collaborate and make it possible to investigate and present various methodologies for doing science in society. Science seeks to explain phenomena that for a long time were attributed to deities.

We inherited the search for knowledge from the Greeks, beginning with philosophy and advancing to the science we know today. Initially, everything was philosophy, "natural philosophy," not different from science. Several philosophers of science sought to make this distinction from scientific work through the epistemology of the problem. Then, discussions arose about what was observed in nature, seeking to disconnect a world that acted through supernatural forces from situations governed by laws that established some order in nature. In this way, we could value scientific knowledge.

Protochemistry began to exist when the chemical activities in primitive civilisations started to be observed, from 4500 BC until the beginning of our era. Based on knowledge of routines in the civilising groups in which the subjects were inserted, the raw material of their activities came from the abundance of natural resources available in nature. In this concept, activities can be divided into metals and metallurgy, glasses and ceramics, dyes and pigments, and drugs and medicines (Maar, 2008).

For astrologers, the minerals we call metals referred to the planets that compose our solar system due to their influence on human life, namely: Gold – The Sun; Silver – The Moon; Copper – Venus; Iron – Mars; Mercury – Mercury; Tin – Jupiter; Lead – Saturn. Identifying these metals did not go through analytical methods, considering that the methods in natural philosophy did not allow those analyses. As presented by Maar (2008), the properties of these substances could vary according to the quantities in which each element participated in its composition. They were identified through sensory factors or the physical properties of each material.

Activities involving the handling of ceramic materials are considered the oldest in human history. Those ceramic materials were the basis for work on glass composition, whose structure is still not entirely known, even after so many years of production and research. Glass emerged as the evolution of ceramic products by vitric coating processes. When combined and subjected to high temperatures, some ores were observed to fuse, generating new pieces that were similar to ceramics but which had a translucent feature that differentiated the visual appearance of the parts. Centuries later, the presence of some ores were seen to confer the parts different colours, depending on the composition. "The behaviour of the different pigments (metal salts) must have been strange to the ancients because only today the knowledge of the spectroscopic behaviour of ions explain the colours" (Maar, 2008, p. 72).

Pigments and dyes were used in the staining of ceramics, glasses, and fabrics made of different materials. These pigments were of animal, vegetable, or mineral origin. In Egyptian culture, the following colourations were widely used: red – iron oxide; yellow - clay and iron mixture; blue – azurite, and green - malachite. Greek ceramics were decorated with paintings of colours: red – iron oxide; black – manganese oxide; blue - copper minerals, and white - phosphates.

> Mineral pigments were used practically pure, or subjected to some purification process, or used with additives such as limestone, gypsum, and others, or mixed to obtain new colours. Some were synthetic, such as the "Egyptian blue" ($CaCuSi_4O_{10}$) mentioned above, and the "Chinese blue," chemically close ($BaCuSi_4O_{10}$). The absence of a stable natural blue pigment, in addition to Afghanistan's extremely expensive lapis lazuli [$(Na,Ca)_8(SiAlO_4)_6(S,SO_4)$], reflects the great material and symbolic value of blue among ancient peoples. (Maar, 2008, p. 73 – 74)

Medicines were widespread in Chinese, Hindu, and Mediterranean cultures. Plants of various species were used as a form of treatment for illnesses, wounds from battles, diseases in general. Some of those plants were used for those medicinal purposes and food preparation because they are aromatic herbs. "The first treatise on pharmacology to show illustrations of the botanical species cited, and the first known botanical drawings are due to the 1st-century BC pharmacologist Crateuas" (MAAR, 2008, p.79).

Some accounts of the definition of alchemy emerge with the search for long and eternal life. It is also related to the process of transmutation of other metals into gold. "Alchemy is the art of liberating parts of the Cosmos from its temporal existence and achieving perfection, which for metal is Gold, and for man longevity; and then immortality, and putting an end to redemption" (Sheppard, apud Maar, 2008, p. 86). The Greeks were the first civilisation to begin studying the composition of matter. The philosophers sought to know how the research, known as a philosophical doctrine, formulated by Leucippus and his disciple Democritus of Abdera, considered an answer to the characteristic of mutation that Greek philosophy had on Earth, was constituted and would be relevant. Chemistry, formerly called alchemy, as a matter belonging to science, was cited in the 17th century. The alchemists – which were considered witches because of how they transformed nature - worked on various scientific concepts.

The initial idea of researchers in the field of science emerged in Greece with philosophers who were interested in thinking and questioning the actions of nature by a logic where events had a cause for the effect they caused, removing the accountability from the deities revered by the society at the time.

> From then on and especially during the 7th century BC, the expansion of techniques — already disconnected from the primitive conception that attributed them divine origin — began to offer humankind explanatory images endowed with a high dose of rationality, leading to progressive rejection and replacement of the mythical view of reality. The technique that humankind can understand and master to the point of performing it with their own hands, repeating it and, above all, teaching it, is a process of transformation and creation. (Pessanha, 1973, p. 17)

Tales de Mileto is said to be one of the first responsible for studies that considered the composition of matter, reporting that water would be the essence of this composition. "Water would be physis, which, in the vocabulary of the time, encompassed both the meaning of "original source" and that of "process of emergence and development," perfectly corresponding to "genesis"" (Pessanha, 1973, p.19). The Greek philosophy arose through the idea that water is the origin of all things; that everything in the universe has water in its composition. Tales proposed broader ideas about water than just a scientific finding that would be difficult to refute. Still, he overcame the barrier of science by exposing this representation of unity through the water hypothesis. Tales did not overcome the lower stage of the physical notions of the time; he jumped over it.

> The first philosophical cosmogonies, proposed by the Milesians and Pythagoreans, can be seen as variations of bodily monism: the diversity of existing things coming from a single bodily physis (either water, air, or numerical unity). However, the very divergence between thinkers - each pointing to a type of arché and a type of process capable of transforming it into so many and so different things — raised the need to investigate the human resources of knowledge, seeking a path of certainty that would overcome multiple and discrepant opinions (Pessanha, 1973, p.24).

Through the cosmological and mathematical conceptions of Pythagoras' initial ideas, it was possible to have the notion of an interval in the units of measurement that would have the same extension dimension of a unit. With this, the number of extension units when clustering tended to an infinite proportion. Through the reformulation of the notion of space, there was a contribution to the principle of the atomist school, a school that began with Leucippus of Miletus and Democritus of Abdera, and the atomist theses resurfaced with Epicurus and Lucretius in the Hellenistic period. "None of Leucippus' writings came to us, but it is widely accepted that he existed; and some of the writings of his pupil Democritus (ca. 460-ca. 370 BC) are known" (Greenberg, 2009, p. 5)

> However, a tradition dating back to Aristotle attributes to this contemporary of Empedocles and Anaxagoras (mid-fifth century BC) the creation of the atomist theory. Starting from the statements of the Eleatics — particularly that the affirmation of the movement presupposes the non-being — Leucippus and Democritus would have concluded that precisely because the movement exists (as the senses show), the non-being (corporeal) exists. Thus, for the first time, the existence of emptiness is affirmed. And in this emptiness the atoms would move, inseparable (physically indivisible, although mathematically divisible) (Pessanha, 1973, p.39 - 40).

It was believed that the atom would have a defined and indivisible size, moving in all directions and had as transport the dust that floated through the air. Thoughts about the interactions those atoms could make, their possible combinations, what they could generate, and for what purpose they would be employed were already being elaborated. For Pessanha (1973), from the philosophers' point of view, the movement of those atoms could cause a kind of a whirlwind, attracting several loose or grouped atoms to the centre. Thus, it would be the beginning of other universes parallel to ours.

Following the thought of the constitution of matter, Aristotle proposes the idea that the combination of the four terrestrial elements, with a fifth element responsible for the union with others, always combine in the form of pairs, trios, quartets or all in themselves. This element is ether, because its volatility can permeate and combine with the elements.

In the Renaissance, Paracelsus returned to this questioning of the conception of matter. He believed that the combination of sophic sulphur (element of masculine characteristics), and sophic mercury (an element of feminine characteristics), could be combined with salt, which would be the third element/principle of this conception that gave origin to all things. Thus, Mercury would be the spirit; Sulphur the Soul, and Salt the material body. Figures of squares and triangles are widely used in alchemy books to explain the compositions of the substances that constitute our universe.

The discovery of Brazil, indigenous history, and science

One starts from the principles of human history to support science and chemistry. For a long time, classical historiography gave us a somewhat distorted view of the indigenous communities that first inhabited our territory. The representations were of victims of an exploratory process and of a people who passively watched their culture and teachings be catechised by a Christian–European culture. Through a current search for the true meaning of the peoples who lived here, we learned about their stance in this situation and how this vision we have been presented for years can change, resignifying the history of the native peoples.

> As we know, Portugal colonised Brazil and considered all its lands to be under Portuguese rule. Then the indigenous peoples' problems began, getting only worse over the years with the consolidation of the colonisation process. From colonial Brazil to the present day, this article provides a very brief overview of the history of the recognition and regularisation of Indigenous Lands (Terras Indígenas - TIs) in the country. (Araújo, 2004, p.26)

The "New Indigenous History", as we can call it, has the main objective of reframing indigenous action in our culture and observing the similarity of everyday activities with the formation of scientific knowledge. When the Portuguese arrived here navigation in search for spices, they met thousands of indigenous peoples, who spoke different languages, had another expression of religiosity, ancestry, and culture, models of labour organisation, education, and society.

The process of invasion and domination of the land and native peoples culminated in the current exploitation of Brazilian soil, and today, more than five centuries afterwards, radical and determining transformations in the original peoples can be observed. A long process of physical and cultural devastation wiped out gigantic groups and countless indigenous ethnicities, especially through the historical rupture between the natives and the land.

> Ideas such as "immemorial customs" of indigenous occupation in a given region are common, as is the current characterisation of the indigenous way of life through their connections with "nature," or with some "natural ecological niche of Indigenous Lands and Conservation Units" that would eventually configure what would be "their land." Apparently, proving the continued occupation of an area by an indigenous group and, from this historical relationship, characterising an indigenous way of life from their adaptation to the occupied environment would be sufficient to configure the relationship an indigenous group maintains with "their land". (Gallois, 2004, p. 38 – 39)

The indigenous people of our model of society carry traits of the original peoples, such as using natural resources, knowing indigenous medicine, organisation, and work techniques and collective practices. These are means for the conservation of the culture and biodiversity of our country, as portrays Silva (2018, p.481), "we can capture very significant theoretical and methodological elements for the analysis of the social-historical process experienced by those peoples and apprehend the contemporary web of threats to the very continuity of the existence of indigenous life." Those peoples' lives are very similar to what we know today as rural daily lives, where many rural families descend from original peoples or extinct indigenous tribes.

> […] those transformations experienced by Brazilian indigenous people have not erased the ethnic traits that socially unite indigenous groups. The specific forms of social organisation are present in elements that give inter and intraethnic unity to various expressions of work culture, economic, social organisation, and spiritual experiences. (Silva, 2018, p.481)

The history of indigenous peoples in our society is marked by violence and neglect. Not only our country but the whole South American continent was inhabited by countless peoples of different cultures and customs, called "índios" (Indians) by the Europeans who landed.

> Brown, naked, with nothing to cover their private parts. They carried bows in their hands, and their arrows. They were all coming straight towards the boat. And Nicolau Coelho beckoned them to put down their bows. And they deposed them. But there could be no talk or

> understanding of them that would profit, because the sea broke on the shore. He just threw him a red bonnet and a linen cap he had on his head and a black hat. And one of them threw him a hat made of long bird feathers, with a top of red and brown feathers, like a parrot. And the other one gave him a bunch of white, tiny beads that look like pearls, which I believe the Captain sends Your Highness. And with this, we returned to the ships because it was late and there could be no more talk with them, because of the sea. (Caminha, 1963, p. 1)

There were hundreds of people with skin whose tone in the brightness of the sun seemed reddened. With their black hair and no fabric covering their genitals. None of them was relevant to the "discovery" by the Europeans, who ignored all the culture existing in these lands, establishing their religious culture, removing the customs, religiosity, and science developed by the Amerindian peoples.

> There was one who was all the time telling the others to stay away. But it did not seem to me that they respected or feared him. The one who was trying to drive them away was bringing his bow and arrows. He was dyed red by the breasts and back and by the hips, thighs, and legs until low, but the voids on the belly and stomach were his own colour. And the dye was so red that the water did not eat or undo it. Instead, when he came out of the water, he was redder. (Caminha, 1963, p. 4)

The tribes that inhabited our lands had contact with other civilisations through the Portuguese and Spanish navigations in a period known as the Renaissance, at the end of the dark ages. Now everything that brought novelty and light, in the figurative sense, was seen with good eyes. The search for conquests made new teams reach the new continents and absorb everything that those new lands could offer them.

> In Gruzinski's view, this was the first true globalisation move that occurred on the planet, as it involved all continents known to Europeans. There were exchanges of goods, people, plants, and animals, ideas, books, in an almost frenzy to broaden the horizons of Europe and other peoples, contained in much smaller spaces and scope until the end of the fifteenth century. [...] There were exchanges in all kinds of activities. As an example, we can just verify the extraordinary number of food and medicinal plants in the various parts of the world. (Filgueiras, 2015, p.29-30)

This process of globalisation idealised by the Renaissance provided an accumulation of knowledge from the social interactions between the pioneering and pioneered civilisations. "Contributing in a preponderant way to what is conventionally called the scientific revolution, which can be said to be part of an even broader revolution of all human knowledge and activities in the Renaissance world" (Filgueiras, 2015, p.30).

The path to this new ocean of science, this new environment, caused some discontent and intolerance from the part of the Catholic Church. A peripheral vision was created, and a new historiographical, cultural, scientific, and religious construction began in these new lands full of colours, flavours, aromas, and experiences.

> The evolution of science appeared as a more complex phenomenon than it was supposed to have, with influences and reciprocal feedings of diverse, fascinating, and intricate, but at the same time more humanised, natures. Science emerged as a human construction that is, with all mishaps, without pretending neutrality, arising and developing to satisfy material urgencies and the incoherent human need to know the world around us. (Filgueiras, 2015, p.33)

The first work activity practised on our lands by Portuguese explorers was plant extraction, especially of the Pau-Brasil tree, which today gives our country its name. From this action, exploration began to be better accepted. The Portuguese Crown invested more in sending people to Brazil, and with them came the Jesuits, who collaborated for the catholic action as a way to colonise the natives, seeking to adapt them to the European catholic life. By then, they started to be inserted in a huge cultural load different from what they had already had for more than 4000 years, as, according to studies based on protochemistry, the activities involving agriculture were already practised by this time. According to Filgueiras (2015, p.33), "Science emerged as the human construction that is, with all mishaps, without

pretending neutrality, arising and developing to satisfy material urgencies and the incoherent human need to know the world around us."

The extractivist practice that the Portuguese carried out had no relationship with modern chemistry and its activities. However, the natives dominated several processes, which we can observe in some examples in research and development of new products for society.

> Among the first chemical practices in Brazil, one cannot fail to mention, of course, the production of medicines from the most varied plant species. Interestingly, modern pharmaceutical chemistry has increasingly used this "primitive" knowledge, cultural heritage of indigenous communities, especially in what is conventionally called ethnobotany. (Farias, 2010, p.23)

Many cultures have used natural paints for more than 5,000 years. We can observe data since the Neolithic era as an example of the actions that thousands of years later would be used to compose the social organisation of the time. The Egyptians utilised saffron, turmeric, and indigo in their arts, such as paintings of houses and temples, dyeing of clothing, and document writing.

> The Brazilian wood, red as the ember - *brasa* - (hence the name, Brazil) would be for decades the main product extracted by the metropolis, being also the target of smuggling by the French. Its Tupi name, *ibirapitinga*, means wood or red tree. The dye extracted from the tree (*brazilina*, which exposed to air oxidises, becoming *brazeilin*) was widely used for dyeing fabrics and to produce ink for writing. (Farias, 2010, p.22)

The chemical composition of those pigments is not perceived in Pero Vaz de Caminha's letter to the Portuguese Crown, the historical document that presents Brazil to Europe. We can use other sources to characterise and group them into classes that favour their best use both physically and through chemistry teaching proposals.

Body painting has much significance for the indigenous people. The paintings vary according to the sexes and age group of the tribal components, not forgetting that each tribe has a distinct identity from the other, as observed in figure 1, making different ways of artistic expressions in their cultures. "They bring all their foreheads, from temple to temple, painted of black dye, which looks like a black ribbon the width of two fingers" (Caminha, 1963, p. 6).

Figure 1: Indigenous Painting, Source: Marcelo Camargo/Agência Brasil, 2015

Painting patterns are inspired by symbols that are observed in nature. As an ink, they use the liquid extracted from jenipapo mixed with charcoal and the seed that we know today as annatto, bringing orange-red colourations. "And they were full of little red grains which, crushed between their fingers, crumbled into the very red ink of which they were dyed. And the wetter they got, the redder they became" (Caminha, 1963, p. 6). In general, they express the idea of "back and forth," common to cosmology, in

which everything that is set into motion returns to the point of origin from an intermediate point of its route. Body paintings are immediately suspended when someone dies, remaining throughout mourning.

> The original native populations were swallowed (and decimated) throughout the colonial period by the imposition of a new system of life. The very construction of national identity, of State power in the Brazilian reality, places the indigenous people in a radically peripheral, subaltern condition, to obey and effectively fit into the system of norms that refers to their own lives. (Silva, 2018, p.494)

The main raw materials consumed by most indigenous peoples are Brazilian wood, annatto, jenipapo, and coal dust mixed with some greasy base responsible for fixing the paint on the skin. The substances extracted from the jenipapo undergo oxidation and generate a bluish-black colour and, in many cases, mixed with coal to enhance the colour.

To obtain the white pigment, they use limestone. The annatto seeds were boiled next to the water until a paste was formed and then mixed with babassu coconut juice, andiroba oil, among other sources of fats of vegetable origin, which would become the fixing agent of the dye due to the fatty characteristic of the product.

METHODOLOGY

The process of compiling texts that show similarities or not leads us to perform a careful evaluation of this grouping about a general topic or theme of the research. To this end, the construction of the state of the question involving the research was made possible from a systematic review of literature, which appears in a study from the issue at stake, seeking in literary repositories studies that assist in its execution. For Demo (1988), it is necessary to know how to formalise the collection and analysis, in a systematic, orderly, and disciplined way, so that the steps and procedures bring reliability to textual interpretation.

The State of the Question presents how the problem under study is presented in the scientific literature, collaborating with the characterisation of the object of study, evidenced by a theoretical-methodological approach. According to Nobrega-Therrien and Therrien (2004), the "state of the question" explores and enables a broad bibliographic range, as it grants the researcher, by identifying and categorising the selected academic production, solutions to solve the research problem, and thus provides the advance for new scientific contributions. We set out the historical period between 2014 and 2019 so that we could investigate more current studies and situate how scientific research is in the history of chemistry in Brazil.

The central ideas of each work were presented so that its specificities can be understood, observing the points of convergence and divergences of this research. The following descriptors were used in this construction: história das ciências, História da Química no Brasil, extração de pigmentos e pinturas indígenas (history of sciences, history of chemistry in Brazil, extraction of pigments, and indigenous paintings).

In this State of the Question, we presented how national history is approached in a scientific and artistic view, after all, culture and science are allies, holders of diverse knowledge that intersect at various times. A search was conducted for papers in the catalogue of dissertations and theses of the Coordination for the Improvement of Higher Education Personnel (CAPES) based on the descriptors: história das ciências, História da Química no Brasil, extração de pigmentos e pinturas indígenas (history of sciences, history of Chemistry in Brazil, extraction of indigenous pigments, and paintings), which make up the research. The State of the Question was constructed through the content of 19 studies that make up table 1 and have concordances and similarities in the general approach of this research.

Nº	Title	Author	Type	Major study area	Year
1	O estado do conhecimento das pesquisas sobre história e filosofia da ciência em periódicos da área de	Flávio Tajima Barbosa	Master's dissertation	Science and mathematics teaching.	2016

	ensino de ciências: Um olhar para a educação em química/The state of knowledge of research on history and philosophy of science in journals in the area of science teaching: A look at chemistry education				
2	A temática "cores" no ensino de química/The theme "colours" in chemistry teaching	Ângela Renata Kraisig	Master's dissertation	Science education: chemistry of life and health	2016
3	Padrões que conectam: o *godidigo* e as redes de socialidade kadiwéu/Standards that connect: the drawings and the kadiwéu networks of sociality	Maria Raquel Da Cruz Duran	Doctoral thesis	Social anthropology	2017
4	O trato das plantas: os intermediários da cura e o comércio de drogas na América portuguesa, 1750-1808/The treatment of plants: the intermediaries of healing and the drug trade in Portuguese America, 1750-1808	Danielle Sanches De Almeida	Doctoral thesis	History of sciences	2017
5	As concepções de professores de química sobre a utilização de elementos da história e filosofia da ciência no ensino/The conceptions of chemistry teachers on the use of elements of history and philosophy of science in teaching	Marcos Paulo Hirayama	Master's dissertation	Science teaching	2015
6	Interculturalidade no currículo da disciplina de ciências na escola indígena tatakti kỳikatêjê: possibilidades de realização de um projeto societário/Interculturality in the curriculum of the discipline of sciences in the indigenous school tatakti kỳikatêjê: possibilities of carrying out a corporate project.	Messias Furtado Da Silva	Doctoral thesis	Multidisciplinaire	2019
7	Caracterização da ontogenética do pau-brasil (Caesalpinia Echinata Lam.)/Characterization of the ontogenetics of Brazilian wood (*Caesalpinia Echinata* Lam.)	Liliane Baldan Zani	Master's dissertation	Plant physiology	2014

8	A natureza da química em fontes históricas do brasil colonial (1748-1855): contribuições da história da exploração mineral para o ensino de química/The nature of chemistry in historical sources of colonial brazil (1748-1855): contributions of the history of mineral exploration to the teaching of chemistry	Haira Emanuela Gandolfi	Master's dissertation	Science and mathematics teaching.	2015
9	Concepções de professores atuantes e em formação sobre história da química e a natureza da ciência/Conceptions of in-service and pre-service teachers on the history of chemistry and the nature of science	Anderson De Oliveira Santos	Master's dissertation	Science and mathematics teaching.	2016
10	Corantes naturais da cultura indígena no ensino de química/Natural dyes of indigenous culture in chemistry teaching	Vânia Costa Ferreira Vanuchi	Master's dissertation	Science education	2019
11	Vermelho e negro: beleza, sentimentos e proteção entre os tapirapé/Red and black: beauty, feelings, and protection among the tapirapé	Vandimar Marques Damas	Doctoral thesis	Image cultures and processes of mediation	2016
12	Desenvolvimento e caracterização de uma coloração capilar a base de extrato do fruto genipa americana l/Development and characterisation of a hair colour based on extract of the fruit *genipa americana* l	Andréa Vasconcelos Machado	Doctoral thesis	Biodiversity and health	2018
13	Com lápis, urucum, traços e borduna se faz o currículo intercultural: o caso da escola indígena Pataxó Coroa Vermelha/The intercultural curriculum is made with pencil, annatto, traces, and a club: the case of the Pataxó Coroa Vermelha indigenous school	Stéfano Couto Monteiro	Master's dissertation	Basic education teacher training	2015
14	Manual do vermelho: um resgate analítico-experimental do pigmento vermilion e dos pigmentos vermelhos medievais através da antiga alquimia da pintura a óleo/Red Handbook: an experimental	Marcio Alexandre Pulga	Master's dissertation	Visual Arts	2016

	analytical rescue of the vermilion pigment and medieval red pigments through the ancient alchemy of oil painting				
15	Educação em ciências naturais na perspectiva do currículo intercultural: histórias contadas por professores indígenas/Natural science education from the perspective of intercultural curriculum: stories told by indigenous teachers	Ivone Mary Medeiros De Souza	Doctoral thesis	Formação de professores para a educação em ciências e matemática/Teacher training for science and mathematics education.	2019
16	Ibirapitanga: rastros e impressões/Ibirapitanga: tracks and prints	Fabiola De Almeida Salles Mariano	Doctoral thesis	Visual Arts	2017
17	Estudos sobre a educação para as relações étnico – raciais e a descolonização do currículo de química/Studies on education for ethnic-racial relations and decolonisation of chemistry curriculum	Antônio César Batista Alvino	Master's dissertation	Chemistry	2017
18	Transformação da matéria: uma abordagem sócio-histórica do conceito moderno de transformação química/Transformation of matter: a socio-historical approach to the modern concept of chemical transformation	Maricleide Pereira de Lima Mendes	Doctoral thesis	Philosophy and history of sciences	2018
19	Estudo fitoquímico da bixina e fração oleosa extraídos da bixa orellana biomonitorado pela atividade leishmanicida/Phytochemical study of bixin and oil fraction extracted from *bixa orellana* biomonitoring by leishmanicidal activity	Daniela De Araujo Vilar	Doctoral thesis	Desenvolvimento e inovação tecnológica em medicamentos/Technological development and innovation in medicines	2015

Table 1: References selected for analysis. Source: Provided by the author

The discussion occurred through the analysis of the materials collected by observing the theme of the works selected. The contents that were initially thought for the composition of this research involved the historical approach of chemistry, by the theme of extraction of pigments, where theoretical and practical classes on the composition and chemical structure of the pigments that were observed when the Portuguese arrived in our continent would be proposed.

RESULTS AND DISCUSSIONS

Discussions in the light of historical-dialectical materialism

The works of Barbosa (2016), Hirayama (2015), Gandolfi (2015), Santos (2016), and Mendes (2018) incorporate the concepts of the history of philosophy and science (HPS), where each brings a different approach and with different historical times. In sequence, the first text addresses how HPS is inserted in science teaching through official documents, for the development of the concept of science in daily activities. The second paper presents HPS and the history of chemistry (HC) in science education so that their elements are inserted in the teaching and learning process of this science, seeking to investigate the teachers' concepts in the use of those concepts in their classes.

In the third, the investigation discusses how HFC is inserted in chemistry teaching and in the construction of scientific knowledge. The fourth investigates how teachers in initial education understand the history of chemistry and the nature of science. The fifth brings the discussion of incorporating the contents of chemistry for human formation and about the social-historical context in the construction of scientific knowledge by the content of chemical transformation. Those studies are close to my theme due to the issues involving the inclusion of the HPS and HC theme in chemistry teaching as a form to construct scientific knowledge from official historical documents, discoveries, dates, studies, and research in the area of chemistry.

In the search for works that address pigments, colours, or the processes initially observed in Pero Vaz de Caminha's letter to Don Manuel, the works of Kraisig (2016), Vanuchi (2015), Damas (2016), Pulga (2016), and Mariano (2017) were analysed. The first two studies have the theme colours, where one addresses the chemical aspects of colours and the use of organic and inorganic dyes in foods, and the other research uses the approach through the history of dyes used in the period of the discovery of Brazil in teaching organic chemistry. Damas observes in his research the productive activities of the Tapirape village, so that through their culture they can develop a teaching that involves the history of their tribe, where they perceived that the components of the tribe produced paints for body painting.

Pulga has his investigation based on the vermilion pigment used in oil paintings, used in the Middle Ages and early Renaissance period. We can observe that this block of works is the only one that uses the term pigment in an idea close to ours in this research. In his study, Mariano brings the historical context of using the Brazilian wood as a source of pigments to perform dyeing of fabrics, the processes of exploration, and the use of the raw material. He brings in his text other types of pigments, but the focus of the research is only the Brazilian wood.

We will now recollect the works that depict some indigenous activities observed in the analyses. Duran's research investigates the drawings of the Kadiwéu people and seeks to understand how the village approaches the use of their graphics in artworks. Besides bringing shamanic and artistic meaning, the codigigo are used in construction and knowledge of the culture and science involved in all these processes, from the collection of dye through natural pigments to the meaning that each combination of painted traits brings to their works. Almeida, in turn, discusses how indigenous medicine was relevant to botanists who explored our biomes in search of spices and the relevance indigenous medicines had when inserted in European and Eastern cultures.

In the search for works that addressed national history in the teaching of science/chemistry, we could find works such as those of Silva (2016), Monteiro (2015), and Souza (2015), which bring with them a point of alignment that is the resignification of indigenous culture, traditional knowledge, as a way of constructing scientific knowledge. Silva's thesis deals with the traditional knowledge of the indigenous people Gavião Kỳikatêjê. Souza works in the Canauanim Community addresses indigenous school education in the axis of natural sciences to promote the intercultural curriculum, and Monteiro used the proposal to implement a curriculum that seeks to bring more of the indigenous culture to school spaces, and that can be used as sources of knowledge construction within the Pataxó Coroa Vermelha indigenous school. The alignment of those texts with my research aims to value the culture and history of the first peoples of our country, and that can be recognised as science and inserted in the curricula of all educational models.

Regarding the theme of pigments observed in Pero Vaz's letter, we obtained three works that address the theme. However, they are not related to the teaching of science. Zani (2014), Machado (2015), and Vilar (2015) bring a technical approach to the content. Zani brings in her text the issues involved in all stages of the exploration of the Brazilian stick, characterising the species and Machado

uses jenipapo as the basis for his research, where its extract, genipine, can be used as a raw material for the production of hair dyes, from the observation of the interaction of the pigment with the keratin, in this case, he uses as reference the indigenous body painting method that for many centuries, since before the colonisation of Brazil, already used this pigment to make traces of black colour on the skin. In her work, Vilar brings the issue of the use of the pigment bixin in the treatment of Leishmaniasis disease, where the characterisation was carried out to know the ways this pigment was extracted and applied in the treatment of the disease.

In the investigations, we could not find studies that associate HC with rural education, as their educational model is still in the process of being clarified to society. Although not so different, it is more contemplative of nature and work issues. Rural education presents itself in the various works as an organisational position of society.

In that analysis, rural education and the history of the indigenous people in the scientific sectors of exact natures were found to be similar in the scarcity of research involving those themes, while the authenticity of the research can be perceived, an idea that will be developed at another time and encouraged to be disseminated in the various educational poles. Whether on the coast, mountains, or backlands, the flag of popular education based on our history, our people, and our raw materials will always be raised.

CONCLUSION

In this question, the general objective of the research was to analyse the teaching of chemistry through the theme extraction of pigments explored in the period of colonisation of Brazil by compiling dissertations and theses from a systematic review that takes us to the situation of research and references to achieve this objective. The theory of science or the philosophy of science that the historian believes also exerts a decisive influence on their approach; their position in a social class also ends up influencing them (Moradillo, 2010, p.160). The study of the history of sciences can present students with situations that they possibly go through in their daily routines, and the presence of science goes unnoticed. HFC can assist the teaching of chemistry as a methodology that performs the exchange between science and society.

When faced with the results obtained in the investigation of the contents addressed in the dissertations and theses selected, the absence of research involving this historical period as a builder of scientific knowledge was perceived. The analyses allowed us to find several gaps in history that are still unknown, due to the fear that some communities will lose their history and culture just as the great historical loss we had in our country through the exploitation of the Portuguese colony.

We also noticed the absence of research involving this historical time of our country due to the decimation of several cultures, and the remaining ones being prevented from receiving visitors because of the history of invasions of indigenous lands. Another relevant point to be commented on is the absence of studies related to the teaching of chemistry in settlement schools through the theme of extraction of pigments or by teaching chemistry through HPS.

By choosing the dialectical method, we can observe the movement of contradiction in some studies and observe the historical movement, the totality of the research through the philosophical, material, and scientific dimensions. In this sense, the search for overcoming a fragmented teaching that does not contemplate the interests of society seeks broader scientific knowledge. We can understand the need for research and study of historical documents to contextualise HPS with knowledge hidden in the various cultures around the world.

History presents how a community is organised and inserted within a society, and from the exchanges of experiences, human beings build their identity through social and scientific formation. Articulating popular concepts that can be inserted in educational environments and through the historicity of men express the historical movement as a dialectic of the movement that constitutes it.

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CONTRIBUIÇÃO DOS AUTORES

Autor 1 -Elaboração e desenvolvimento do projeto, coleta de dados, análise dos dados, escrita do texto e revisão da versão final do artigo.

Autora 2 -Orientação da pesquisa, participação ativa na elaboração dos instrumentos da pesquisa e análise dos dados, escrita do texto e revisão da versão final do artigo.

Autor 3 -Coorientação da pesquisa, participação ativa na análise dos dados, escrita do texto e revisão da versão final do artigo.

DECLARAÇÃO DE CONFLITO DE INTERESSE

Os autores declaram que não há conflito de interesse com o presente artigo.

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