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MEDIAEVAL ARABIC BOOKMAKING AND ITS RELATION TO EARLY CHEMISTRY AND PHARMACOLOGY

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Very little effort, in the past, has been made to study the relationship of Arabic chemistry and alchemy to the truly original and remarkable development of its contemporary, pharmacological science. To this end, the materials of a significant text on chemical technology have been studied together with those found in pharmacological texts, both in manuscript and in print. Where possible, names of botanicals and other materials of the technological text have been traced in the literature of chemistry and the materia medica from the earliest literate times down into the Arabic period and later. The etymology of these terms and their geographic distribution are of interest particularly for study of the paths of transmission of science from 3500 B.C. on.

Further, this study from source materials was made to assist the student of mediaval science in his understanding of the scarcely known technological aspect of Arabic culture. The translation, as much as possible, is given with the view that it is the techniques and materials used which must, above all, be clarified. It is for the professional Arabist to carry on further detailed work in the philological difficulties of Arabic technological vocabulary exhibited in this text, as well as in the peculiarities of North African dialectal expressions of the eleventh century.

The major manuscript studied, like most of the others used, is frequently lacking in diacritical marks, thus making it difficult to ascertain the reading and meaning of rare technical terms. In transliterating Arabic words, the Library of Congress system has generally been followed. In the case of the diphthongs, au and ou have been used interchangeably. The same is true for ai and ay. For simplification, the plurals of rafi and mulk and dhl have been anglicized but left in italics. The word dirham, since it is so common, has not been italicized.

Value of weights. The grain is a unit of weight. The carat equals 4 grains. A dirham equals 16 carats and is slightly less than 3.2 grams. Seven miliqds equal 10 dirhams. An ounce equals 12 dirhams. A rafi equals 12 ounces. One dahl equals 1/6 of a dirham. One dirham equals 4.5 miliqds.

Where a reference book or article has been divided into sections and each section numbered, the reference given refers to this number. Otherwise, the reference is to the page.

It is a pleasure to acknowledge the many kindnesses and the expert assistance given to me by Professor Noury Al-Khalesy, Mlle Berthe van Regemorter was kind enough to give me helpful suggestions in regard to the art of bookbinding. To Professor G. K. Bosch, I owe thanks for allowing me to read her manuscript on the twelfth chapter of the Ibn Badis text before its publication. Professor Bruno Kisch shared some of his expert knowledge of weights with me as well as his library. Dr. Jerry Stannard was very kind in reading the typescript. To Mary McGilnchy Levey belongs the credit for many ideas which are now unidentifiable because of their complete absorption and diffusion throughout the work. I am also grateful to my colleagues in other than mediaval science who in many conversations and in correspondence offered assistance in many fields upon which this work touched and in other tangential matters. I am indebted to Temple University for assistance, and to the American Philosophical Society for grants for research which always seemed to come at an urgent moment in the course of the work. Completion of this work would have been very difficult without the support of the National Science Foundation and the National Institutes of Health (RG 7291). Finally, I wish to thank the Institute for Advanced Study for a year of quiet study where I thought about and commenced this work.

I dedicate this work to Susan Levey and to Peter Levey.

M. L.
CHEMICAL TECHNOLOGY IN MEDIAEVAL ARABIC BOOKMAKING

MARTIN LEVY

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INTRODUCTION

1. TECHNOLOGICAL WORKS IN ISLAM

Study of the technical arts of mediaeval Islam has received scant attention compared with other branches of this rich culture. One of the major reasons for this circumstance is that historians of technology are often insufficiently versed in the necessary range of languages and philology. Another cause lies in the difficulty that relatively few works have survived from the Golden Age of the Muslims, approximately ninth to twelfth centuries.

Much of the Arabic chemical literature is alchemistic in nature. Because of this, the student of the manuscripts is given a distorted view of the actual chemical knowledge of these people. There is, however, a small number of texts, in sharp contrast to the alchemical writings, which are devoted to the crafts of the time. These deal directly with or are tangential to technology and are of importance comparable to that of the alchemical works. Owing to their highly practical disposition, a much clearer view of the extent of Muslim chemical knowledge is thus imparted to the reader.

The latter type of literature is represented by the presently studied work of Muḥammad ibn Bīdilis, c. a.d. 1025, on bookbinding. Although the treatise is deficient in some aspects of the subject, it is, nevertheless, a rich repository of practical chemistry in the fields of tanning and dyeing of leather, manufacture of glass and their uses as adhesives and vehicles for paints, and the preparation of inks of many types for application to different writing materials.

Another work is given in translation in the appendix. It is by a master craftsman and is devoted largely to bookbinding. Since the ibn Bīdilis manuscript has little on the actual art of bookbinding, the addition of this work should prove to be complementary to the former work. Its author is al-Sufyanī, a North African. It was written in a.d. 1619. In addition to bookbinding, there are included descriptions of covering of the boards with leather, solution of gold and its application, manufacture of glue, dyeing of leather, and engraving of leather.

2. THE EARLY ISLAMIC BOOK

The codeform book (masāfīf, from the Ethiopic) was known in early Arabic times. In fact, tradition has it that during Muhammad’s lifetime, the Koran pages were kept between wooden boards (badārī or def. jūsām). Later Zād al-Ṭalḥī, before the end of the seventh century, copied it into book form.

Fortunately, the Arabs in Ṣa‘īdah, South Arabia had


4 Cf. review of P. Richet’s text in Revue Africaine 41: 153-151, 1928.

an excellent and flourishing leather industry. Large tanning works, a necessary concomitant for a book-binding industry, were also to be found in Kharran, Juras, Suir, Zabul, Bukhara, Egypt, Maghrib, and Spain. It was in Suir that the white and yellow-stripped Cordovan leather was produced to rival the famous Moroccan leather of al-Ti’d. This leather is mentioned in one of the texts to be discussed. Not only was leather a major product of this city but the region was known also for its excellent bindings. It was recorded in 985/6 that al-Murqaddi, the bookbinder, received two dinars for a binding of the Koran in Yemen. In the Muslim Empire, bound books were very expensive although copying was supposed to have been done very quickly. Bookbinders, book-sellers, papermakers, and others who relied on the book trade flourished in this period. The bookstores were frequented by the intellectuals just as much as earlier and later times. The Fihrist, in 987/8, mentions bookbinders who were well known. The famous practitioners of the art listed are ibn ahl al-Harish, who bound books in the library of al-Ma’mun (early ninth century), Shabat al-Majdi al-Ujajji, Abu ‘Isha ibn Shirin, Dimyat al-A’far ibn al-Hajjaj, Ibnbrahim and his son Muhammad, and al-Husain ibn al-Saffar. The bindings of these men have been lost.

Millions of volumes probably existed in the Golden Period of the Muslims. In Cordova alone, the library boasted of 250,000 books. Owing to the deprivations of various groups many libraries were burned and other-
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fortunately, has not been able to procure a copy of the 1924 edition. The 1919 edition has been used in this study.

Further manuscripts have been examined on this subject—(8) Berlin 5563 (Spengler, 1939). No title is given nor is the author listed. Seggel believes it is a fragment of a "manuscript of Zain ad-Din 'Abdurrahman al-Halabi" and described as a "fragment of a manuscript in Baghdad by the Mongols. The library of the Grand Master of the Assassins in Alamut burned in A.D. 1257 as did that of the Qafilah." Not a major product of this city but the town also for its excellent bindings.

3. SOME MANUSCRIPTS USED IN THIS WORK

The manuscript (1) upon which this study is mainly based is in the Oriental Institute, University of Chicago, catalogued as A12060. This is a copy made in 986/8, by al-Maqaal, the librarian of the library in Baghdad and was transferred to the great library in the Egyptian Library in Cairo. It was purchased by the Institute from Dr. B. Moritz in Berlin in 1929. It is equivalent to MS Landberg 637 in Berlin which is dated 1228/1313 and is called 'Ißamul

The manuscript of which a translation is given is (7) 'Ißamul-abbâs al-Halabi ibn 'Abdul-Allah ibn Ahmad ibn 'Abd al-Rahman ibn al-Qasim ibn al-Halabi. This manuscript is in...
the Muslim book. It may be inferred that the brush primarily was meant to be used with the paints in this chapter. They could not have been used with the ink preparations in the next chapter.

Colored inks, according to Ibn Bādīs, fall into three groups, red, yellow, and green. Although other colored inks are described as violet, white, blue, and pink, these were evidently considered the most important. Peacock blue ink made with gum is mentioned. Blues which are transparent tended to be lean and opaque when laid with glair. There is nothing in the manuscript to indicate that the author was aware of this. In Latin texts of the eleventh century and later, the well-established practice was to temper blues with glair. Gum tempering was less generally recommended than tempering with glair.

In later mediaeval times, gum tended to displace glair. The gum was largely used for brushwork while the glair was for tempering pen colors. Not many glair recipes are found in Ibn Bādīs. The use of some type of gum was much more common. The compromise of the use of glair plus gum is more apt to be found in Ibn Bādīs than glair alone.

Some of the other pigments used are of interest. One of them, "yellow arsenic," is orpiment. Although orpiment, As₂S₃, is found in nature, its preparation was well known to the alchemists. Cennino in his work, Il Libro dell'Arte a Trattato della Pittura (early fifteenth century), states that orpiment is artificial, meaning that it was made by the chemists of his day. Other golden colors are described by Ibn Bādīs.

Verdigris was a very common green pigment, in fact, it was one of the basic materials of illumination in the early mediaeval period. In Ibn Bādīs, this is the favorite green in spite of the fact that botanical greens are much better since verdigris is much more reactive with the commonly used orpiment. Holmyard has shown that Mary the Coyp (or, third or fourth century) knew that vinegar and copper produce the pigment verdigris. An exact procedure for its manufacture which would control the variation in the color of verdigris is not provided by the ancient literature.

The two most important red pigments were cinnabar and red lead. Classical writers in Pliny and Isidore used minium for cinnabar as well as for other red materials. (Minium = the source of the Latin and Italian minium, "to miniate," "to rubricate" manuscripts. Minutaria then gives the English "miniature." )

Much confusion is found in the Latin terminology for cinnabar. The preparation of red lead, Pb₃O₄, is well known in many manuscripts. Its orange color when pure is very difficult to preserve.38

It is of further interest that some recipes contained lac. Gum, however, is always present. It seems to have been used partly for its rich lustrous finish. The purpose of a solution of gum or oil in ink is to bind the writing in a state of suspension and to act as an adhesive. This was not always clearly understood so that gum is found in recipes for inks which are active chemically and so do not require an adhesive. In the case of papyrus, parchment, and certain sized papers, the ink often was left as a paint. In this event, the gum was essential. Less important properties of gum are that it retards a certain viscosity for a time when proper care is taken and that it serves to protect plant derived matter from more rapid decomposition.

Some of the ink recipes in this chapter contain galbat in spite of the fact that the tannins have a deleterious effect on the colors although a small amount prevents the formation of mold.

6. IROS

The lyra, ink-soaked wool or felt wads, were meant for use with the pen. They were made in a greater variety of colors than those pigments prepared for the brush. The inks for ink were prepared in essentially the same manner as were those used for the brush.

Gold-colored inks were very common. These were prepared from the yellow pigments of various botanics.

There does not seem to be much reason for the ingredients in some recipes. For example, in the preparation of a white ink, to white lead and mica are added gum arabic, gum tragacanth, and fish glue. It would not only be difficult to use but almost impossible to keep. Another recipe has the two gums together with lac.

It may be recalled that gum tragacanth swells enormously in water so that when it is used as a temper the colors should be bound with a minimum of it.

The proportions in the recipe do not bear this out. Gum tragacanth contributes little to the optical effect but is effective as a binder. It is likely that Ibn Bādīs himself was not a practicing craftsman in this art.

7. MIXTURES OF DYES AND COLORS

For mixtures the basic colors are given as white from white lead, black from ıı ink, red from cinnabar and red lead, green from verdigris, yellow from orpiment, and red from cinnabar.

The text is concerned not only with the mixing of these so-called basic pigments but also with their tinting.
It may be inferred that the brush meant to be used with the paints in this section could not have been used with the ink in the next chapter. According to Ibn Bads, fall into three categories: yellow, green, and red. Though other colored inks such as violet, blue, white, and pink, are evidently considered the most important, black ink made with gum is considered transparent, but it is essential to mix with glau. There is nothing in the manuscript to indicate that the author was aware of the texts of the eleventh century and later, and his practice was to temper blues with green ink, a custom that has passed through all the ages. The composition of the red ink is more to be found in the alchemical tradition.

Other pigments used are of interest. One may ask: "what is the nature of these substances?" It is important. Although it is not found in the chemical preparation of the red ink, the alchemists, as we know them, had a strong tradition for the use of the red ink. How can the pigment be identified? The ink in the alchemical tradition is said to be composed of a variety of colors that are part of the preparation for the use of the ink. The ink for the red ink was prepared in the same manner as those used for the brush. Gold-colored inks were usually prepared in the same manner as those used for the brush. They are often colored with gold or silver, in various media which do not detract from the metallic luster. Gum tragacanth is an excellent vehicle in one recipe. Silver ink is made with silver in essentially the same way. A substitute for silver in a recipe is given as tin (or lead). The amalgam is formed and then pul
erized; the gums are then added. Another recipe for a silver substitute includes unalike lime and glue. The best metallic inks in the nineteenth century were still made with pulverized gold or silver in the same way.

In the medieval period there were two main types of ink, one made by Ibn Bads and the other by other hands. The latter has been noted for its metallic luster and its use in metallic inks. The inks are related to metallic pigments and belong to an earlier section. There are two recipes for copper inks. Copper inks, of course, cannot retain their color for long in the atmosphere. Sympathetic inks are generally defined as those which are not subjected to a certain treatment, either change color, vanish, or appear. The recipes given by Ibn Bads belong to the last category. They include recipes for green, brown, palm, and white vitriol as primary ingredients. The secondary materials are gallotum, ashes of paper, and balsam. Heat is sometimes required. These inks are of little practical value.

9. ERASURES FROM PAPER AND PARCHMENT

Many of the recipes in this section of the treatise for a detailed treatment of the manuscript, vinegar solutions, along with salt in orange, are used to remove inks. A rough eraser is made of "gilded" acorn from which the outer, softer, or more flexible, the reddish or red from the ink. The ink used by the Arabs was not ink which did not react chemically but penetrated the paper physically. This ink is difficult to remove as it is a very sensitive type. Since carbon ink was so difficult to discharge, the Arabs simply covered it, as they did with other inks with a type of paint preparation.

A manuscript gives a receipt for erasure fluid. Wax is melted and then saturated with incense. This is used when necessary. Then, when you put it on the writing, aman it. As often as the spot is whitened, return to another spot until a trace of writing does not remain.

This was simply a covering procedure, not actual eradication. Another one different in effect is. Take Venetian alam, salt and sulphur in equal parts. Soak them in vinegar until dry. When dry, it is like dough. Work it on to layers. Leave it until it is wiped. Ammonia had been used earlier. Then the layers on the ink are removed. There does not remain a trace of the ink.13

10. GLUES, ADHESION OF GOLD AND SILVER, POLISHING

The two main types of glue used are fish glue and snail glue. In medieval times, it was not enough to use glue on the gold leaf itself. The gold size from fish and snail glue has sufficient gelatine for adhesion to parchment. However, it may not be sufficient to insulate against any chilling off under the burning. Therefore, gilding experts applied adhesive to the parchment or paper.

In some recipes throughout the text, honey is employed. A little of it is sufficient to keep the binders, as glazed the right of the sizes in the traditional recipe. Avoid excessive brittleness when dry and to maintain a slight flexibility. This helps to prevent cracking. Sugar is a hydrophilic adhesive which can be employed for this purpose. In this text, it is fairly certain that sugar is used only for the formation of its tiny crystals which when dry give a sparkle to the ink.

But Bads does not give definite instructions on the making of fish glue. This was because it was so common.15

It was made from the skins, bones, and entrails of various species of fish.16 Glue was also obtained from scraps of hides of the animal. The detailed procedure is given in the
text. An elaborate description of the preparation of glue is given by a craftsman, al-Sufi. See appendix. For polishing Cennino used harkomite burnishers. The teeth, he says, of dogs, lions, wolves, cats, leopards, and of all clean carnivores are also good. These were well polished to round off any sharp edges.

11. MANUFACTURE OF PAPER AND ITS TINTING

Paper is manufactured in the text from flax. There is a fairly full description particularly showing the care exerted in the operations. It is one of the earliest descriptions in Arabic. Paper, however, was known much earlier. Originally, paper came from China over a caravan route through Central Asia and Persia. At Samarkand, the route divided, one branch going to Kashgar and the other to Scinde. At the latter, paper from the sixth century has been discovered. Papermaking was later developed fully in the Islamic world when, in 751, Kao Hsen-chih was defeated and several Chinese papermakers were captured and put to work. Samarkand had abundant crops of flax and hemp as well as sufficient water. From here paper came to the West although the transmission took about 500 years. What may be the oldest sample of European paper, although there is as yet incomplete proof, is a document dating from 1109 in Palermo. It is an order in Greek and Arabic concerning a salt mine near Castro Giovanni issued by the wife of Roger I of Sicily.

According to Ibn Badis, the flax is soaked in quicklime, rubbed with the hands, and spread out in the sun to dry. It is then returned to fresh quicklime. This is repeated a number of times. Then it is washed free of the quicklime many times, pounded in a mortar, washed, and introduced into molds of the proper measure. Care is exerted so that the thickness of the paper is regular. It is then left to dry. It is treated with rice water or bean water. Search is also used for this purpose. It also helps to glaze the surface of the paper.

12. BOOKBINDING AND ITS TOOLS: COLORING OF PAPER; GLUE FROM LEATHER SCRAPS

Part of the text is concerned with the binding of books and the necessary tools. There is a brief description. The leather for binding is declared to be more desirable when well tanned and soft. Procedures are given to correct improperly tanned leather. When the leather is dyed, alum is used as a mordant. Tannin and iron compound are used to color leather.

black. Cattanias is employed together with qul, a mixture mainly of sodium and potassium carbonates.

The coloring of paper was practiced in the time of Ibn Badis. The text outlines a simple procedure. In a later manuscript, it is given in more detail:

On the dying of paper. If you wish to dye paper red, then take ten dirhams of bakh and the same amount of soda. These are kept warm. Sweet water is poured on the soda, then boiled until half of it has evaporated. It is clarified, then the bakh is added to it. A small amount of buyas is added, then cooked until half of it has evaporated. It is removed from the fire and cotton is soaked in it. The paper is coated with it, then polished. If indigo is mixed with red arsenic, paper soaked with it, and kept warm until dry, then it tends to a yellow color.

Another description. Cook ħijāt until it is green, then soak the paper in it until it is green. Polish its surface, keeping it warm in the atmosphere.

Another description for yellow. Mix water, the ground stone, and arsenic. Then it is polished. It comes out nicely. Or take ten dirhams of verdigris and a dinar of sulfur. It is mixed with water and the paper is dyed with it. It comes out the color of meave.

For verdigris dyeing, take the last verdigris. It is put with bloodstone in a mortar, then washed and purified. What was purified is placed in the water to use as a dye.

For a rase colored dye, bakh is mixed with a little white lead, then used to soak the water in.

It is surprising that the coloring matter was not added to the pulp before it was put into the molds. Only the already molded sheets seem to have been dyed by the Arabs.

An interesting process is described for the manufacture of glue from leather scraps. Following an ancient Samarian procedure, it involves depilation of the leather, soaking in water in a vat until disintegration, then heating and filtering. When cold, it is cut into small pieces.

Immediately following the end of the twelfth chapter where acknowledgment is given and prayers are made to Allah, a number of notes are given. These are concerned with the testing for genuineness of such substances as white lead, verdigris, mercury, opium, musk, and others employed in the text. Most of these tests to prevent falsification of the materials are very simple, easy to perform, and empirical in nature.

13. CHEMICAL APPARATUS AND PROCESSES

The chemical apparatus and processes in the Ibn Badis text display a very definite similarity and link with that in the Arabic and Alexandrian Greek alchemy.


† Probably Rinomus al-Qādir, al-Main, 93, L, 1403.
† Probably Chartes Olivaire, L.
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as well as with that found in Babylonian chemical technology. Some of the apparatus employed by the ihn Bādīs include:

Vessels
jarab—a clay container
qanīd—a clay vessel that can be heated in a furnace
qanīrīd dispel—storage vessel buried in dung
qdēr—a pot which can be heated
qēm(p)ām—a flask with a narrow width that can be heated
qāqūlī—long necked flask
qarab uk-anāy—curved and ambit
qbūn—bush, tab, amorpha
qarab u-lath—flat dish
karmāzīkhī—glazed pot
huqūq—container used to dissolve glue
qāqūlī—glazed dish
qāqūlī—glass used with a very wide mouth
Ovens and furnaces
farna—a baking oven
ālān—a furnace
ālān al-nuṣṭār—furnace for glassmaking

Other apparatus
māṣqīl al-ṣalīr—leather sieve
māṣqīl qāqūlī—millers sieve
ṣūkūlī—sieve
ṣūkūlī—sieve
bīlān al-qāhīy—iron delugrating spoon
qūlī—pot
qūlī—stone on which pulverization takes place

With necessary exceptions, the apparatus in use by the chemical technologist in this text is reminiscent of that used by al-Razi in Secret of Secrets, an alchemical book, and by al-Kīnī in his book on perfumery. Thus the processes in use by the chemical technologist are similar to those in use by the alchemist. This is supporting evidence that the chemical technologist or master craftsman was aware of much of the knowledge of the alchemist. The insinuation here is that, at the beginning of the eleventh century, there was no gulf between theory and practice in chemistry.

It has already been demonstrated that early Muslim chemists were aware of a considerable debt to Babylonian chemistry for its apparatus and processes. Islamic chemical technology is also under the same obligation.

15. CHEMICALS IN ARABIC TECHNOLOGY AND THEIR SOURCES

The ihn Bādīs text demonstrates not only the two important lines of evidence, i.e. apparatus and pharmaceutical knowledge, but also their origin and development.

16. CHEMICALS IN ARABIC TECHNOLOGY AND THEIR SOURCES

Theihn Bādīs text demonstrates not only the two important lines of evidence, i.e. apparatus and pharmaceutical knowledge, but also their origin and development.
times from India to Spain were thought to be valuable in many illnesses. Astringent substances were universally employed for "drawing flesh together" in wounds, boils, and other suppurative lesions. For example, myrobolan was prescribed for pastes of the mouth.  

Some of the simples were restricted to external use because they were poisons. Others, such as narcotics, were for obvious uses. Aside from remedies of the type mentioned, there was some measure of agreement in the pharmacological uses of a few drugs. Those which were employed for diverse types of ailments were more difficult to identify in many cases since their properties were not sufficiently delineated.

A statistical evaluation of the etymology of the thousands of chemical terms used by the Muslims will help shed a proper light on the three questions posed above. The previous discussion is meant primarily to bring to the attention of serious students the possibilities of linguistic and statistical applications to the history of ancient science.

Because of the need for an ancient materia medica, botanical studies were kept alive and flourishing; this was particularly true in medieval Islam. Owing to the scarcity of technological literature and the relative abundance mainly of medical writings among ancient

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and medieval peoples, it is possible that the one strong thread which helped retain much of the ancient knowledge of the materials used in chemical technology was this medical and allied literature. This literature together with that on the later alchemy, all worked toward the retention and strengthening of chemical technology. This, together with the father-son apprenticeship system, served to carry on the transmission of chemical technology.

15. TESTING THE PURITY OF MATERIALS

The last part of the Ibn Bīḍīs text is concerned with a number of notes on how to determine the genuineness or falsity of the materials to be used in the work. Not only are these probated by their physical properties but an attempt at chemical testing is made. In early Arabic literature, the physical tests of color, odor, taste, and others, were commonly used. Ibn Masawwī (A.D. 777-857), for example, in his Tāwāsir an Ṣimpbl Ḡermaryt Substances employed physical but no chemical tests although he was much concerned with the purity of aromatics. Throughout the Arabic period, there was a development of chemical testing methods to ensure greater purity of materials. To a major extent, the motivating force was a commercial one.

Most of the chemical changes are carried out by Ibn Bīḍīs with the aid of heat. Otherwise, they are performed by adding water or drying in the air. The physical changes of the resulting reactions are observed.
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and mediaeval peoples, it is possible that the one strong thread which helped retain much of the ancient knowledge of the materials used in chemical technology was this medical and alchemical literature. This literature together with that on the later alchemy, all worked toward the retention and strengthening of chemical technology. This, together with the father-son apprenticeship system, served to carry on the transmission of chemical technology.

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by

Al-Murīzī Ibn Bāḍīsī

In the name of Allah, the Merciful and Compassionate One.

First Chapter. The excellence of the pen, the line, the choice of the best pens, their selection and differences according to the appearance of their lines, description of the inkwells, and the choosing of its instruments from the knives and others.

Second Chapter. On the making of the kinds of soot ink. 23

Third Chapter. On the preparation of the types of black soot inks. 24

Fourth Chapter. On the preparation of the types of colored soot inks. 25

Fifth Chapter. On the preparation of ink. 26

Sixth Chapter. On the tinting and mixture of dyes.

Seventh Chapter. On writing with gold and silver and their substitutes.

Eighth Chapter. On putting down secrets in the book.

Ninth Chapter. On the preparation of covers for the writing on paper and parchment.

Tenth Chapter. On the preparation of glue from snails, solution of fish glue, adherence of gold and silver, description of its polishes and the polishing, hair quills, pen quills, and all the instruments for gold and silver.

Eleventh Chapter. On the preparation of paper. 27

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21 A glass reed is Staff of the Scribes and Preparation of the Discerning on Writing and Preparation of Soot Inks, Dyeing and Gilding, and Solution of Gold.

22 *Māshid*, from *maṣāfi*, to stretch out (i.e. the ink). (This is not the same as that in medical literature; for example, in Dioscor. [v. 162] there is a compound medicine made of root of pine wood, from *muṣāfā*, and *al.*

23 *Rūs*, from *hara*, to write. *Māshid* indicates a joint point of ink whose important ingredient is soot. *Rūs* refers to an ink which resists chemically with paper or parchment. It is usually a gall-stained type of ink. This distinction was often later blurred.


25 *Al-qālid*; also *al-qālid*.

26 *Liq. is a piece of wood or felt which is soaked in ink and placed in the inkwell. The pen is dipped into this. It is still used in the Near East. Its advantages are that it cannot be spoiled by travelers or children, it cleans the pen as it is dipped, and the ink is held in a "state of suspension."*

27 *Kātib*.

28 *Bāḍīsī*.

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Twelfth Chapter. On description of bookbinding in leather, the leather covers, and all of the instruments so that it will suffice for one to do his own bookbinding with leather.

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FIRST CHAPTER

ON THE IMPORTANCE OF THE PEN AND WRITING

The blessed and exalted Allah referred to "the inkstand, the pen, and what they write." The Exalted One said, "Read, by your generous Lord who taught you by pen." And the messenger of Allah, may Allah bless him and peace be upon him, says that the first significant thing that Allah created was the pen. [2] And he said, "Flow, and it flows with whatever it is, until the day of ressurection. And Ibn ʿAbbas said, in the word of the exalted Allah, "Entrust me with the treasures of the earth since I am a guardian and a learned one." This means a curator of records. And of the honor of the pen, [without which no book was written, ibn ʿAbbas, with whom Allah was exalted, was pleased, commented upon the Exalted One's word, saying, "the pretty writing." This is in a commentary on the Exalted One's work, "When they find their pens made of sticks, their names written on their tops [i.e. of the pens]." Some of the commentators have said that the Exalted One said that he added in the creation whatever he wishes, thus beautiful writing. And the prophet, may Allah bless him and give him his peace, said, "Beautiful writing gives to truth more clarity. It demonstrates that when the pens are good, the books smile." The pen is the molder of speech. It melts whatever the mind contains. Anything which the pens have given fruit the ages have not dared to erase. But the pen is a tree and its fruits are the words and the thought is the pearl of wisdom.

Description of the choice of the best pens, their selection and the variation of their appearance in the...
kinds of writing. Description of the inkwell, selection in its thinness, thickness, the inside length and shortness, and measure of its sides. One puts a spit in it, that is the tip of the pen, below its middle and its head, as much as a thumb. Its spits are interrelated in thinness and pointedness. This spit is from the middle two-thirds up to the head of the pen. The fatter it is in weight, the more artful the pen. (3) If it is short, then it is thicker and stronger. The preferred length should have oil in it. No corner is left; so nothing may be gathered on the thick nib on the inside and the edges. If the pen is even, the writing comes out thin and not so pretty. If it is diagonal, the line comes out weak. The most beautiful and best of the properties is the goodness of the average one—between the long and short, the thin and the thick, the diagonal and straight, the edge and the inside. It has more resemblance to the writing by ink on paper and copy books. As to any other than these, they are not so desirable. The best of the reeds is that which is proportioned in its length, its body, and its hardness. The chosen one is that which has a redness within it and is more oily. It is necessary for the preparation of this pen that it be sharpened from its head, that is, the thick part of the reed. If the contrary, then it is weak. So, it is necessary that the pen be sharpened from its lower point since it is stronger than its head. This is the fine section of the reed. Be aware that it is not so adaptable for the diagonal one as it is for the straight one when it is in the hand of the writer. Therefore, it is essential that the nib of the pen be straight.9 It has a corner by the right split section. It may be thought of as having edges. It is necessary that there be a split of the pen in the middle. The distance of the nib to approximately the place where the pen is held, is as long as the distance of the joint of the small finger to its head (i.e. the head of the finger to its first joint). What one usually sharpens and writes with is a quill. For the thickest pen, some of the fat in its head is removed. Only a little remains. If the fat from the beginning to the end is of the same consistency, then the flow of the pen is easy. Otherwise, the line is not beautiful and it is bad. If its head has much fat, it does not write. (4) It is necessary that this be taken into account.

The writing of the straight pen is stronger and smaller and is more permanent. According to the opinions of the scribes, it is better and more beautiful. The writing of the diagonal pen is weaker than others but more beautiful; it resembles writing on paper. The middle one between them has both characteristics. The length of its head assists the light hand in speed of writing. That which is shorter is just the opposite of that. If the sharp edge of the pen is long, its writing is lighter and weaker. If it is short, its writing is stronger and heavier. What is selected and recommended is the medium one in the three cases. This is the one which is average, between the long and short, its thinness, diagonality, and roundness. The best of the pens is that prepared by shaving away its sides in the middle so that the pen point is a little wider than the middle. The length of its edge is as much as the pen. More than that or less spoils it. The man puts the knife on the reed straight. His hand should be not to the right nor to the left, not crooked or reversed so that it does not go a little to one side. It is done with the right hand grasping the knife so that it can cut. It causes the knife to cut on an angle and not perpendicularly. Otherwise, the pen is nicked and the parts are jagged. Putting it in the middle safeguards the two edges of the pen. Scraps8 it off slowly, little by little, as a toothpick is scraped. The oil of the pen is average, neither thick nor thin, so that the going is easier for the pen. (5) If its oil is in excess, the pen is slow. If it is thin, it flows weakly.

If you begin to cut the pen, then cut it vis-à-vis the plant of the reed, i.e. the small hole in the lower part of the reed. It seldom is spoiled if done that way. If you wish, scrape off the pen. Do not work on the two sides at once, not with the middle, and not with the fat. Take the knife and scrape off one side. It will take a long time to make it straight; you will have to stop. Then, begin first with the middle of the two edges so that twisting is avoided and its form remains true. Its lower part becomes shortened and then it is the right that is fuller than the left. This is a necessity for writing. If the left is Fuller than the right side, then it will spray and so ruin the writing. While you split the pen, keep firm. Do not make haste or you may slip from the proper path. The value of the pen depends upon the correctness of its split. This has been described. The same is true for its cutting. The true way is for the right edge to be full while the left edge is a little less so. If you prepare it according to what has been described, then cut it medially, neither long nor short, tending, however, toward the long. This is the choice of all writers. If this is so, then it is correct in its flow. When you cut it, cut it straight. It is necessary that the pen be cut while the edges are together. It is then opened. The writing then is more beautiful. (6) If it is cut and it opens a little, then it is that it may split. This spoils it. If its opening becomes very wide and it is cut after that, then the damage has been done. For this reason, the pens of the common people are damaged. They do not know how to cut the pens for they have no idea of it. Perhaps they may cut it after they write with it. That happens to those who do not care for beauty and straightness of writing and the perfection of this art.

Description of the knife for pen cutting.9 As to the knife it is essential that it be of iron, the best and the


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TRANSLATION OF MANUSCRIPT OF IBN BADIS

VOL. XI, PT. 4, 1903

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Description of the inkwell, selection of the pen, and ink. The inkwell is described in the middle of three cases. The inkwell is of the kind that is made in Alexandria and is the best of the three. The design is of a square shape with a depression in the middle. The inkpot is made of a small piece of stone, and the pen rests on a ledge inside of the inkpot. The pen is of the kind that is used in the north of Egypt. It is made of a long, thin piece of reed that is used for writing. The ink is of the kind that is used in the north of Egypt. It is made of a combination of gum and water. The ink is used for writing in the north of Egypt. The pen is used for writing in the north of Egypt.

ink. Take lampomint, tar sweet, gum of scammony, gum arabic, and sweet of sap of the pine, each of one a drachma. Knead with water of the gum. It can then be used.

(8) Description of India ink. Take cow's butter and mix it with the cow's butter, and the same amount of oil of balsam. Knead it in the mortar and mix it with oil of balsam. Then put it in a vessel.

(9) Lamomint, lampomint. This stone was known to the early Egyptians (nos. 138 and 145) and Egyptians (nos. 138 and 145). In India, it was well known in Rhassoul as an emetic. It is used in the treatment of digestive disorders. It is known as an emetic and is used in the treatment of digestive disorders. It is known as an emetic and is used in the treatment of digestive disorders. It is known as an emetic and is used in the treatment of digestive disorders.

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Over it put another vessel. Light a fire under the former vessel which contains oil and whichever oil you wish until it becomes like vapor, all of it oily, and has risen into the outer vessel. There is a sublimate on the under side of the cover. It is gathered and used with this oil as the first ink was used. This black substance is good for dyeing the hair black.

Description of another India ink. Take two parts of soda or dried fruit of the pine, or of them together. Put it into a new clay vessel and put it into an oven until it becomes charcoal. It is taken out the next morning and pulverized a day on a stone. It is soaked with water of cooked myrrh and a little of vitriol.

"and"

[...]

abu. From the Persian name of a mountain near Hamadan, in Persia, about 180 leagues west of Isfahan (Shirazgar) where the tree grows.

[...] al-anuwar al-dhat. Semanah = fruit of the pine. It is well known in Syria.

[...] sarim.

[...] dam.

[...] nabi.

41. Myrrh, commerson L. In ancient Mesopotamia, o-rim was employed as an aromatic astringent. An infusion of the berries, burnt alive, was used for astringency and prophylaxis of the uterus. In powder form, it was used for scrofula, ulcers, and silicosis, (A.D.B. 381). Myrrh was also used as incense and in embalming. In approximately the 21st century B.C., it was well known in medicine (Lev. xvii, 150). The oldest medical text known, in the Sumerian-cuneiform script, gives a prescription which included the slat of a water snake, corneum (corneum) plant, powdered alual, barley, powdered fir resin, and root of myrrh (Sum. G.L.G.P). All this is boiled together, and then the liquid is decocted. Dioscor.: (1.112) mentions it, assaying, to dye the hair, for eye inflammations, for erysipelas, and ulcers. C.F. I. ii. (69) and al-Rasili (11) for similar uses in the Arabic period. The Twilly al-abdo (11) says that it is also called al-

[...]

[...] al-kaum, mard in Pers. (A.Gold Margin 9).

42. According to al-Razi (10th century), there are five vitriols, black vitriol, gallic, glyceric, oil, and galgum. (C.F. al-Razi 84.) These are described elsewhere in the same text (p. 87-88) as "alum (kalsiyat)," "gallic, which is white vitriol, galgum, which is green vitriol, and zirke, which is red vitriol." There is a confusion of vitriol in al-Razi and other Arabic writers. The term al-jal (in the Persian alk oxide,

[...]

[...]

43. It is found in Salon, Kafir, Serapiam, the Sind, and in other malleable media as aสวมnische, for biliary hammers, and for other ailments. (See Main, 78; Levay, 196, 112.) The brand of poisons and in the medicinal [Man] in Ptolemaic and [Man] in Arabic. The latter are described in the Arab. (A.Gold Margin 9).

44. Quicks (glauca) is prepared according to al-Razi as follows: "Take white pure alum, dissolve and purify it. Distill vitriol and verdigris. Mix them with water of the purified alum and leave it in a beaker."

Quicks (glauca) is cupric sulfate or blue vitriol. This was frequently confused with green vitriol, ferric sulfate. This was probably due to the fact that the vitriols, as was the case with almost all other chemical used in antiquity, were impure. The methods of preparation are given by al-Razi (88) and this is probably due to the fact that the vitriols, as was the case with almost all other chemical used in antiquity, were impure. Then put it in a copper vessel. Dissolve it when you have put a half dihem of ad-ammonium into ten dihem of it.

made according to the mentioned description. It is completely pulverized with water of myrrh, and pulverized with water of gum in such quantity that there is for every nail of pulverized charcoal ink two ounces of water of gum. If a little more is added, it is not harmed. If it is too hard, take the gum from it and knead it. Put it in layers and leave it in the shade. It comes out beautifully.

Description of Kufic ink. Take the kind of pomegranate and procure wood to burn it. Take the ash and knead it with yoghurt and a little of the moistened gum. Then make it into cakes and dry it in the shade. This is then the best type of ink.

Description of another Kufic ink. Take what you wish of the seed of dates. Then put it in a vessel and

"It is better when vitriol is dissolved that it be purified, put into a copper vessel, and dissolved after a half dihem of ammonium chloride has been put in ten dihem of it until solid.

Another type, yellow vitriol, best it, and purify it. Add the same quantities of verdigris and vitriol. Leave it seven days until it is dissolved and is given. Partly it. Let it become solid. To prepare zirke take vitriol, best it, and purify it. Add the same quantity of iron-sulfur. Cook it vigorously and purify it. It comes out red.

Quicks (glauca) in Persia, is probably not a vitriol but in the product of the calcinations of blue vitriol, or perhaps a lime. Dioscor.: (1101 (80) and Galen (XII. 218).

* Note: It is found in Salon, Kafir, Serapiam, the Sind, and in other malleable media as a surname, for biliary hammers, and for other ailments. (See Main, 78; Levay, 196, 112.) The brand of poisons and in the medicinal [Man] in Ptolemaic and [Man] in Arabic. The latter are described in the Arab. (A.Gold Margin 9).

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Description of another Kufic ink. Take Greek pallino and burn them until they became charcoal. Then pulverize it with water of the summer gum. (9) Make it into cakes and dry it in the shade. It comes out well.

Description of another Kufic ink. Take what you wish of the seed of dates. Then put it in a vessel and
t another vessel. Light a fire under the el which contains oil and fat or whichever until it becomes like vapor, all of it oily, in the copper vessel. There is a sudden hiss under the cover of the vessel. It is gathered and its oil as the first ink was used. This black ink is good for dyeing as it is made on another India ink. Take two parts of rered fruit of the pine, or of them together, a new day vessel and put it into an oven. This is baked and kneaded. It is taken out the next day, dried, and ground. It is cooked of cooked myrtle and a little of vibisco.

In the Persian name of a mountain near Hasabad, it used to be used for ointments, wounds, and (5, 501). Myrtle was used by the Persians and in approximately the 11th century B.C., it was well known (Levy, 128, 130). The oldest medicinal test was to make some on the skin of a water snake, commensal to the skin, burned, peeled off, and rubbed. (After GLP). All this is boiled together, then the mixture is placed as a deposit, and with this the deposit is dried. The deposit is dried and placed on the deposit. The deposit is dried. It is a little yellow, hard and dry. It is used to make the deposit and it is dried and placed in the deposit. It is dried and placed in the deposit. This is the best type of ink.

Description of Kufic ink. Take the kind of pomegranate, and put it into a vessel. The ink is made with the deposit of the pomegranate. Then it is made into a deposit and dry it in the shade. This is the best type of ink.

Description of another Kufic ink. Take Greek gallnut and burn it until they become charcoal. Then it is put into the vessel and dry the deposit. It is made out well.

Description of another Kufic ink. Take what you wish of the seed of dates. Then put them into the vessel and dry the deposit. It is made out well.

It is better when violet is dissolved that it is burned, put into a vessel, and dry after a half hour of anomalousochlorine is put in ten deposits at a time until it is dry.

A type of violet, yellow, hard, and dry. It is dissolved in water until it is dissolved and is green. Purify it. Let it become solid. To prepare violet, take the deposit, heat, and dry it, and put it into a deposit made of some kind of iron. Cook it vigorously and purify. It comes out more color.

Quifik or reembedding in Persia is possibly not a violet but is the product of the calcination of a blue violet, or perhaps a kind of aum. Finally, the colors given may indicate the impurities and not the major substances themselves (Mainz, 140, 149).

Throughout the text, a/1 is probably meant to be green violet.

This is a special type of glass furnace.

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THIRD CHAPTER
ON THE PREPARATION OF BLACK GALLNUT INKS

(11) Preparation of black shining ink. Ten parts of gallnut are taken and pressed. On it is poured six of the same water. It is then cooked until a sixth of the gallnut solution has disappeared. It is then purified. It is cooked in one-sixth of its weight of gum arabic, then boiled in a mild fire until one-third has disappeared. It is then brought down from the fire and cooled. One can write with it.

Description of another ink. An ounce of acacia gallnut is taken and pressed with an ounce of gum arabic. They are mixed and there is poured on it a measure of water equal to eight times it. It is put in a flask in the sun for three days. It is filtered after that. Four dirhams of Greek vitriol is put into it, and an ounce of the Iraqi if the Greek cannot be found. If it is summer time, it is left in the sun four days. If it is in the winter, it is left twelve days. It is then put to write with.

Description of another shining ink. Two parts of gallnut are taken and pressed. On one part pour six parts of water and on the other two parts of sweet water. It is then boiled a day and a night. The two are gathered together in a new pot and cooked until its fourth disappears or its third. It is then taken taken down from the fire. It is purified. There is taken for its two ounces of scraping of gold. (12) It is pulverized and sieved, then sprinkled on it. It is returned to the fire until it boils, then removed from the fire and purried. Two ounces of pulverized gum arabic is sprinkled on it while hot until it is nicely melted. Then it is put in a glass pot and used.

Description of instant ink. Gallnut of the terru

both are dry. Then as many layers as desired are made. It is wonderful.

A special ink essence is made for the king from root of refined stone,24 root of the sandalwood, and root of saffraz25 either together or separate. Its root is very strong black. Another ink is made from root of bismuth26 and also from root of sulphur. If it is desired that the pigment be not spoiled and

in wordy and ungrammatical. When given internally, it is supposed to have the power of shortening the cold stage of intermittent fever (Albinc 1:48). Camphor is found in the Viaduct of the Bay, P. History of Chemistry in ancient and medieval India, 11

Babylonian (DAB, 89). Various camphors are in use today so camphor (Camphora cina) is a tree nourishing in Japan, Persia, and Central Asia) is used. They are also used in the Borneo, mint steen distillation of the Borneo, and camphor are today extracted by

frictional dilution. Cf. Apulides (111c) for use for the

17. This was known in ancient Egypt and Babylonian. 

7. In the use of the tree, Citha Indica in

8. This is also a name for bismuth (60). Twifal al-sulph (341), and Mace. (280). It is still used DAB, 335, 346. Cf. also I. B. (1992) and Pliny (XII:37). The origin of Bismuth in Semitic (Caron, 156).

9. There is general confusion in the Greek (Doc. 1:72) plant. This is discussed in the Twifal al-sulph (130). Cf. Dowers Shad (130), and Al-Kilid (185). Zulf is used in many medicinal preparations as well as in the building of liquid containers, espe-

pecially ointments, and on streets as a sealant. For its use in ancient Bismuth and petroleum in antiquity, Leiden, 1966. In India (Jay, imported to the India Valley 8000 years ago.

10. Sulphur was well known in ancient Mesopotamia. Cf. pharmacology. Aristote. Gemeni, and Al-Kilid among others know ancient times a great deal for iveration. It is used much in 18th. Hippocras and Celsus also used sulphur. Cf. Albic (1:41).

Levey (39, 137, 140) for its preparation and use in Babylonian it. Doc. 1) discussed it as a simple. Sulphur was employed in century India and earlier for Irish and carious infections. (414), Nay, pyrein. In Al-Asi (41) sulphur is described. Its nature is described as the nature of the arsenic. When it is added to mercury and then distilled, the author obtained a

similar. In the same way, when mixed with copper, a burned browning and its colorless and whitish depress as with arsenic.

11. Sulphur is discussed in I, B. there not be a bad odor, then take the ink and put it in a vessel. Then enough clear water is poured over it to cover it. It is then bleached from its solution. Its water is changed three days. It is then put into the mortar and sorrel water poured on it, zythog or a bit of table salt, and gum arabic. Then it is beaten in a mortar until it has the consistency of glue. It is then put aside until needed. If it is desired to write with it some of it is dissolved in water.

12. This is also a name for bismuth (60). Twifal al-sulph (341), and Mace. (280). It is still used DAB, 335, 346. Cf. also I. B. (1992) and Pliny (XII:37). The origin of Bismuth in Semitic (Caron, 156).

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similar. In the same way, when mixed with copper, a burned browning and its colorless and whitish depress as with arsenic.
Preparation of ink of the myrobalan. 39 Yellow myrobalan is taken and pressed with seed. It is put in a flat vessel which is then covered with a cloth. Two ounces of salt water are poured on it. It is well beaten. It can be used for writing immediately on paper and parchment.

Description of a black ink. Three ounces of gallnut are taken, an ounce of glass, and one and a half ounces of the period is put on it. It is left for a long while. It is then dissolved in water. The gum is dissolves in water before the cooking of the gallnut; it is completely covered until it becomes viscous like honey. When the gallnut is cooked, the gum is thrown on it. It is left a little while until all is dissolved in it. After it is dissolved, the viritized is put on it. If it is not dissolved, it is not put on more. Never throw the gum on it unless it has been soaked.

Preparation of a dry ink. Green gum is well pulverized until it becomes like collyrium. A part of it is taken, and a part of the gum arabic. The gum arabic is dissolved with water. One half part of gum arabic is prepared. (11) All of it is gathered with gland of egg, gallnut, and gum arabic until it becomes like dough. It is made into a ball and put into a vessel. Ensure that no water is absorbed. It remains food long time. When it is needed, it is put into a vessel. Drip water on it from another vessel in a needed amount until it is dissolved. Then one can write with it.

Preparation of ink for the common people. Green gallnut is taken and pressed in quarters and thirds. It is put in a narrow mouthed flask. Drip water on it panel and put on it. It is then placed on the fire. A low fire is used. When half of it is dissolved, it is clarified. To write with it, for every nayal of water of the powdered gallnut use five parts of the solution prepared and one half ounce of green vitrized. Write with it.

Description of an instant ink. Gallnut of the terrebra. Many substances were called salts by the Arabs (Main, 221). Al-Khol (715) used salt frequently in his recipes. Salt is discussed in I. 12 (3164), al-Razzaq (343), Dioscorides (V; 169), and Serapias (358) among others. Among the others are also discussed in Alzate (51 f., 89-91). The salt is used in the medieval period in most places as a preservative in sea. That which was mixed with more expensive was more expensive. According to the transportation cost. Salt was generally impure.

Tannin. Cf. Leye (13) for Byzantine mortars. Many types of mortars and materials referring to them were known in the medieval texts.

Salt. Cf. Leye (13).

Glass. Pers. gall. Possibly the connection on the surface of impermeable exposed to the atmosphere.

bnît—yellow-green, is taken, green vitrized, and gum arabic—of each a mísqát. It is all pulverized and put into a vessel which is then covered with a cloth. Two ounces of salt water are poured on it. It is well beaten. It can be used for writing immediately on paper and parchment.

Description of a black ink. Three ounces of gallnut are taken, an ounce of glass, and one and a half ounces of the period is put on it. It is left for a long while. It is then dissolved in water. The gum is dissolves in water before the cooking of the gallnut; it is completely covered until it becomes viscous like honey. When the gallnut is cooked, the gum is thrown on it. It is left a little while until all is dissolved in it. After it is dissolved, the viritized is put on it. If it is not dissolved, it is not put on more. Never throw the gum on it unless it has been soaked.

Preparation of a dry ink. Green gum is well pulverized until it becomes like collyrium. A part of it is taken, and a part of the gum arabric. The gum arabric is dissolved with water. One half part of gum arabric is prepared. (11) All of it is gathered with gland of egg, gallnut, and gum arabric until it becomes like dough. It is made into a ball and put into a vessel. Ensure that no water is absorbed. It remains food long time. When it is needed, it is put into a vessel. Drip water on it from another vessel in a needed amount until it is dissolved. Then one can write with it.

Preparation of ink for the common people. Green gallnut is taken and pressed in quarters and thirds. It is put in a narrow mouthed flask. Drip water on it panel and put on it. It is then placed on the fire. A low fire is used. When half of it is dissolved, it is clarified. To write with it, for every nayal of water of the powdered gallnut use five parts of the solution prepared and one half ounce of green vitrized. Write with it.

Cf. Tābān, Tērēbra. Green vitrized was used as a decorative substance in Byzantium. Many substances were called salts by the Arabs (Main, 221). Al-Khol (715) used salt frequently in his recipes. Salt is discussed in I. 12 (3164), al-Razzaq (343), Dioscorides (V; 169), and Serapias (358) among others. Among the others are also discussed in Alzate (51 f., 89-91). The salt is used in the medieval period in most places as a preservative in sea. That which was mixed with more expensive was more expensive. According to the transportation cost. Salt was generally impure.

Tannin. Cf. Leye (13) for Byzantine mortars. Many types of mortars and materials referring to them were known in the medieval texts.

Salt. Cf. Leye (13).

Glass. Pers. gall. Possibly the connection on the surface of impermeable exposed to the atmosphere.
soaked in water for three days. Its clear water is taken
and spread on the bottom.
Preparation of dry ink for travel. The best green
gallnut is taken and well pulverized like a collyrium
paste. Also pulverized for it is the same amount of gum
arabic. Then half its weight is taken of green viridio. It
is well pulverized and all of it gathered in the white of
one or two eggs until it becomes like dough. Then it
is formed into a ball and put into a vessel and stoppered
at the head to prevent the access of air or dust. It is
allowed to stand upright a long time.
Preparation of another powdered dry ink. Gallnut,
gum arabic, viridio, and acacia in equal parts are
taken. All are pulverized with water of fresh St. John’s
bread until it is dried. (25) It is then removed and
dissolved with the necessary amount of gum water
when it is needed. Write with it.
Preparation of ink which is made with the water of
the myrtle alone. Seed of old myrtle is taken and
cleaned in water. For every raft of it, there are dissolved
three rafts of gallnut water and four ounces of the ex-
tract of the twig of the myrtle. Then it is put in the
warm sun for seven days. It is squeezed and clarified.
For every raft of this solution add one-half raft of gum
arabic. It is set down for a day and a night until it is
dissolved. Then there is added to it Cyprian green
viridio in an amount which is enough. If it is worked
with Egyptian viridio, it gives better results. It is
clarified and used to write with.
Preparation of ink with water of the Syrian mul-
berry. (26) The water is taken that flows from the Syrian
mulberry and into it is thrown pulverized gum arabic
and a little water of the green gallnut. The water of
the green gallnut is not increased. It is burned and
suspended in the shade. Every day a dirham of gum is
thrown into it. This is done five times in five days with
a raft of that water. Write with it.
(26) The white of eggs was frequently used by the Arabs for its
adhesive property as well as for the final glazed appearance it
helps to give the ink.
(27) Alarai mentions the yellow Egyptian viridio and
the white, it is uncertain here which is meant. See al-\ Ralph (87).
(28) It is probably an impure ink.
(29) See above.
(30) In Byzantium (2AB, 316-317) the mulberry
was well known as VJ, MEK, MARAB, N in Sumerian and
mushkâdîn in Akk. It was rare in the masiria walks. (31) (126) gives Mount Apian L., where, as the important
materia medica for the stomach and bile. TV is apparently

(16) Preparation of ink for religious books. Gallnut is
taken and pressed to the size of the chick pea. It
is then measured and put in a boiling vessel. On it are
poured three parts of the same water. Then if it is lit
under it until it returns to two parts. It is cooled and
clarified. In it is thrown green viridio, whatever is
needed and gum arabic—for every one of water—a
part and a half of gum arabic. Then write. Some people
who cook it do so until the water returns to two-thirds
or one-third or as desired.
Preparation of ink for owners of religious books. A
part is taken of pressed green gallnut and on it are
poured five parts of water and cooked until it comes
to one and a half parts or one part. It is then clarified
and put into a vessel containing viridio. Viridio is taken
and put into a pot. On it is poured the same amount of
water. It is kept in the sun three or four days. Then
a part of the water of the gallnut and a part of the viridio
are mixed. Before that, gum arabic had been taken and
water poured over it and left in the sun a day or more
until dissolved. Then two parts of it are mixed with
two of water, stirred gently, and then used for writing.
If it is desired that it be deep black, then one-half
ounce of burned pulverized viridio is added. It is used
immediately. Write with it.
Preparation of a dry, black ink. An ounce of gallnut
is taken. It is pulverized until it becomes like dust. Do
the same with gum arabic. It is kept free from dust. It
is then suitable for the best books.
Preparation of another ink. The water of the black,
ripened Syrian mulberry is taken in the amount of a
raft. With it are put ten dirhams of pulverized sieved

gum arabic. A little viridio is added to it. It is put into
a pot in the sun forty days. It is used after that.
Preparation of ink from iron filings. (31) The gallnut is
boiled with iron filings until one-third of the water dis-
persars and two-thirds remains. It is then clarified in a
pot and put in the sun for a day. For every raft of
water, there is thrown on it a dirham of viridio. (37)
Add whatever gum is needed. It comes out wonder-
fully. If a wine color is desired, the gallnut is pressed
and soaked with the filings. To every raft, five rafts of
water are added. It is boiled (35) well and left. When cold
it is clarified. To every raft of water, there are added four
dirhams of viridio. Write with it.
Description of another good ink. Gallnut is taken and
broken up into quarters or smaller. On it is poured
enough water to cover it. It is placed in the sun for
two days. It is pressed and boiled on the fire. The
necessary viridio is added as well as gum.
Description of another ink for religious books. Gall-
nut is taken and pounded down to the size of a chick
pea. It was common in the Muslim world to relate the size of a thing to a seed or some other part of a
common plant or animal.
(31) See above.
(32) See above.
(33) See above.
(34) See above.
(35) See above.
(36) See above.
(37) See above.
Preparation of ink for religious books. Gallnut is taken and pressed to the size of the chick pea. It is then measured and put in a pot. On it are poured three parts of the same water. Then fire is let under it until it returns to two parts. It is cooled and clarified; when water is needed and gum arabic—for every one of water—a part and a half of gum arabic. Then write, some people who cook it do so until it returns to two-thirds or one-third or as desired.

Preparation of ink for owners of religious books. A part is taken of pressed green gallnut and on it are poured five parts of water and cooked until it comes to one and a half parts or one part. It is then clarified and put into a vessel containing vitrile. Vitrile is taken and put into a pot. On it is poured the same amount of water. It is kept in the sun three or four days. Then a part of the water of the gallnut and a part of the vitrile are mixed. Before that, gum arabic had been taken and water poured over it and left in the sun a day or more until dissolved. Then two parts of it are mixed with two water, stirred gently, and then used for writing. If it is desired that it be deep black, then one half ounce of burned pulverized vitrile is added. It is used immediately. Write with it.

Preparation of dry, black ink. An ounce of gallnut is taken. It is pulverized until it becomes like dust. Do the same with gum vitrile and keep free from dust. It is then suitable for the best book.

Preparation of another ink. The water of the black, ripened Syrian mulberry is taken in the amount of a raf. With it are put ten dirhams of pulverized sieved gum arabic. A little vitrile is added to it. It is put into a pot in the sun forty days. It is used after that.

Preparation of ink from iron filings. The gallnut is boiled with iron filings until one-third of the water disappears and two-thirds remains. It is then clarifed in a pot and put in the sun for a day. For every raf of water, there is thrown on it a dirham of vitrile. (17) Add whatever gum is needed. It comes out wonderful. If its color is desired, the gallnut is pressed (18) and soiled with the filings. To every raf, five rasfs of water are added. It is baked (19) well and left. When cold it is clarified. To every raf in the same, there are added four dirhams of vitrile. Write with it.

Description of another good ink. Gallnut is taken and broken up into quarters or smaller. On it is poured enough water to cover it. It is placed in the sun for two days. It is pressed and boiled on the fire. The necessary ink is added as well as gum.

Description of another ink for religious books. Gallnut is taken and pounded down to the size of a chick pea and smaller. It is put into a pot and on it is poured ten times its quantity of sweet water. (19) The fire is kept up until the solution returns to its half or third whichever is better. On it is thrown enough vitrile and the gum arabic in the amount needed. You write with it.

Preparation of another ink. One part of gallnut is taken and mixed with vitrile. All of it is pulverized and covered with water. It ferment for a night. Then add water the next day until it comes to the amount necessary. Write with it.

Preparation of another good ink. A small gallnut without gums is taken in the weight of three ounces and soaked in water in a proper pot for four days. It is put on the fire and good vitrile is thrown on it. It is let sit an hour after the fire has become strong. On it is thrown clean, pulverized gum arabic. It is left a night. (18) With the coming of daylight, it is purified and put in a glass vessel. Write with it. It is a good black.

Preparation of another ink. Gallnut and pomegranate rind are taken, pressed together, and soaked in some water for three days. Then blue vitrile is poured on it little by little while stirring until it is seen that it has become a strong black. If the gallnut is not available, then use its substitute, Persian vitrile. Gum arabic is added. It is then removed from the fire. It is a good ink.

Preparation of an ink with which one writes in copy books. There are fifty masoned gallnuts are taken. On them is poured three rasfs of water. Then it is then clarified and of it is thrown on a dirham of vitrile and nine dirhams of gum arabic. It is left in the sun for a day. If the black is not in it, then add vitrile to make it.

Preparation of still another ink. There are taken three ounces of gallnut, one ounce of vitrile, and one and a half ounces of gum arabic. The gallnut is crushed and on it is thrown eight times its weight of sweet water. It is in the water a day and a night, the longer the better. It is then placed on a low fire for a night until it is reduced by one third. The product of which it has been well cooked is that when the gallnut is squeezed it disintegrates. Then gum is soaked in a little of that water before it is cooked until it is the viscosity of honey. Such gum is then added as is on the fire. An equal amount of vitrile is added. (19) It is then taken down from the fire and clarified. Write with it.

FOURTH CHAPTER

ON THE PREPARATION OF COLORED INKS

Preparation of the red, yellow, and green inks. Twenty shekels (20) of sour pomegranate rind are taken. If it is moist, (21) it is better, else the dry type must be used. Also the rind of the green walnut (22) in the same amount, twenty masoned of the green gallnut (the mulkah of Ishafan antimony) (23) and juice of the myrtle (24) equal to that amount. It is put in the sun for forty days, then clarified and placed in three other vessels. Two of which are to be left open to the air. It is put. It is stirred with the pen. This red ink. Then pulverized verdigris (25) is put in another pot and stirred.

18. Jähr (1:54) states that the name of the ink is derived from the word for the grain of wheat. The ink is called fine or good.

20. The color is derived from the juice of the pomegranate rind.

21. The same applies to the other inks as well.

22. The same applies to the other inks as well.

23. Antimony is a metallic element known for its ability to change color when exposed to air.

24. Myrtle is a plant species that yields a pigment used in ink-making.

25. Verdigris is a pigment derived from the copper carbonate, which changes color upon exposure to the air.

26. The color is derived from the juice of the pomegranate rind.

27. The same applies to the other inks as well.
This is green ink. In another pot put pulverized yellow arsenic. It is stirred. This is yellow ink. When it thickens in the flask, add this water.

Preparation of an ink for parchment especially to make it look like gold. Pure red arsenic which has not been mixed with anything is taken. It is well pulverized. Then pure good saffron without clay or fat is taken and wrapped in a clean cloth. It is put in pure water until the bundle is moistened. It is then squeezed on the arsenic and water of gum put on it. Write with it. It comes out like pure red gold.

Preparation of an ink for people of the sword. One part of gallnut is taken and broken up. On it is poured three parts of water. (20) The fire is lit until the solution returns to one part. Then green vitriol is taken and two parts of the water poured on it and stirred in the vessel for three days. Yellow myrobalan is pressed

As stated, already known for thousands of years, Aristotle's (27) mentions three types, yellow, red, and dust grey. Ibid, 163, notes 2, 3, gives as a Latin synonym diurnam. The "yellow arsenic" is actually arsenic or arsenic while the red is realgar. The red and yellow were the only ochres known to the Arabs. White arsenic is actually As₂O₃. The best medieval description of sulphides of arsenic is given in Alhazen taken from the Arabic and Latin texts. They are rare texts but nevertheless valuable. Cf. op. 84-88. Jibe is quoted in regard to the preparation. Described are the distillation and the washing. Only the red (arsenik alaband) and the yellow (arsenik nigra) are mentioned, thus giving a more accurate picture of the sulphides of arsenic. For arsenic in Byzantium, cf. Levyy (96, 161). Desorcin (V; 164) knew arsenic and arsentic (V: 105), endox and avendite respectively.

Safran. According to Malam. (135), it is also called el-jift or jafat. The Alkohlan "mass perpetrated it is the same thing." (136) The, in the sense of barbat, barchon in Hebrew. Saffron was used in Babylonian medicine with mercury or as a medicinal plant in Egypt. It was used in various technological processes. It is also used as a dye on cotton (Levy, 77, 105). The Sumerian "mass perpetrated R. E. S. A. R. equivalent to S. S. R. S. Mass." Saffron, Coque caratas L. was frequently confused with turmeric, also a yellow dye. Saffron was also used as a condiment (ZAR, 159-160). Discolored (1: 26) (napio) prescribed saffron root as a diuretic. In Indian medicine saffron is prescribed in nervous affections in advanced with vertigo, as 354-357. Al Kindi (190) used saffron in many formulas. It is the warm sun five or seven days. Then the water above the gallnut is removed with a fine cloth. Then for every measure of gallnut, nine of water are used. It is placed in the

Preparation of red ink. Green gallnut in halves or thirds is taken and crushed. For every measure of gallnut, nine of water are used. It is placed in the

Preparation of a ruby red ink. Saffron is taken and crushed. (21) It is then pulverized until it becomes like a paste. It is then beaten with water of the crushed white gallnut as in the first process. Then the redness is examined. If it is close to peacock red, then it is good. As much water is mixed with it as is possible. It is put in a glass vessel. Write with it immediately.

Preparation of a ruby red ink. Saffron is taken and crushed. (21) It is then pulverized until it becomes like a paste. It is then beaten with water of the crushed white gallnut as in the first process. Then the redness is examined. If it is close to peacock red, then it is good. As much water is mixed with it as is possible. It is put in a glass vessel. Write with it immediately.

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LEVEY: MEDIAEVAL ARAB BOOKMAKING
[TRANSL. AMER. PHILOS. SOC.]

TRANSLATION OF MANUSCRIPT OF IBN BADIS

it. In another pot put pulvurized yellow

with its seeds. The seeds are not broken.

On a part of it, there is poured three parts of the water. It is put on

the fire until one part is left. It is good.

Preparation of a red ink. Gallnut is taken

and broken up. From the inside the red and black are thrown

away while the rind of the outside is left. It is soaked

in water after all of it is washed with water. It is put in

a vessel and stirred. When a clean foam

then it is left in its condition until it is dry. It is well

pulverized until it becomes like dust. It is beaten with

that water. It is left for an hour. Gum arabic is put into it.
Write with it.

Preparation of an ink with which one can write on

the same day. An ounce is taken of green whole gall-

nuts. It is well pulverized and sewed with a thick silk

cloth. One ounce of the best Cyproite vitriol which has been

in its eyes of gold is added. It is pulverized and sieved

again. White gum arabic and two ounces of the strongly

shining red type are taken. It is pulverized and sieved.

On the gum is poured a raf of water. It is squeezed with

the hands until it is dissolved. Then the gallnut is

thrown into it and also the vitriol. It is stirred until all

is mixed. Then the redness is examined. If it is close to

peacock red, then it is good. As much water is added

with it as is possible. It is put in a glass vessel. Write with

it immediately.

Preparation of a ruby red ink. Saffron is taken and

washed. (21) It is then put on and it becomes like a

paste. It is then beaten with water of the crushed*

white gallnut in the first process. It is left an hour,

then beaten with water of dissolved gum arabic. It is

then stirred vigorously and used.

Preparation of red ink. Green gallnut in halves or

three is taken and crushed. For every measure of

gallnut, nine of water is placed in the warm

sun five or seven days. Then water above the gallnut is removed with a fine cloth. Then for
ten
twelve days of pulvurized five or ten of it is taken. It is

well pulverized. Seven dirhams of good vitriol are

taken and the gum arabic poured first. When the
gum is dissolved, then the vitriol is poured on it. It is

stirred by hand, that is, with a pen. If the color on

the pen becomes white, then not a thing is added. If

vitriol is added, then it will burn.

Preparation of a yellow ruby colored ink. Yellow

myrobolan is taken and sooted with its seeds and

cooked. One ounce of pure green vitriol is cooked with

water of the putrid of the gallnut. Write with it. It comes out beautifully.

Preparation of a peacock-blue ink for parchment.*

103 purdākī nātij. Usually spelled gurātābīn. It is a flask with a

long neck (Weli; 617); zājīlī = goz.

104 mawānīr. Like a ink or a paint.

105 maw‘irī = morāfīl.

106 jilītīska.

107 jilītī jilāwī.

108 jilītī jilāwī. This also sounds like a morafīl.

109 abātūn, abātī, abātūn, abātī, abātūn.

110 abātūn, abātī, abātūn, abātī, abātūn. It is thought to be a

corruption of a word used by 111 Blind.

111 Blind. Such a village according to Yaqīn (6. 1179-1220) in

Ma‘alūn al-baidin (Beirut, 1955).

112 jilītī jilāwī. This also sounds like a morafīl. Probably

113 sa’īnī jilāwī. Sometimes spelled jilāwī. It is

occasionally used for unfixed inks and for food colors.

114 jilītī jilāwī. This also sounds like a morafīl.