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Foreword

Dear reader,

It is a pleasure for us to announce that the first issue of 2023 has been published. As the previous interim Chief editor Patricia Engel commented in issue 2/2022 of Conservation Update, this journal has undergone some changes recently. Today, as the two new chief editors of Conservation Update, we both feel honored and happy to have accepted the proposal for the position by Patricia Engel, and we hope we manage to keep the journal at the same high level as our previous colleagues.

The development of this issue (1/2023) has been made possible and easier thanks to the collaboration and mutual support that we, as co-Chief editors, had from each other, sharing our knowledge, doubts and thoughts. Obviously, we would like to thank Patricia Engel for having guided, supported and oriented us on how to proceed with this new role. Without her, it would not have been possible. In addition, we are thankful for the support and help of a great team; the interdisciplinary board of peers, the native proof-readers and the designer of the layout, who have all worked together voluntarily, keeping up with the open and international character of the journal.

Our first goal was to keep the high standard of the journal, while having a central theme that would stimulate the prospective authors as well as the readers. For this issue 1/2023, which is our first issue working together, we had the pleasure of receiving a very interesting article which explores traditional conservation methods of Persian origin that can be applied to modern conservation practices. We hope that you enjoy and learn from it as much as we did when we received it in our inbox.

We would like to take this opportunity to thank the author of this fabulous article Mandana Barkeshli along with the reviewers of this article, proofreaders Katarina Kelsey and Charlotte Wilkinson, for the layout Anja Props and for her guidance and support Patricia Engel.

For the next issue, 2/2023, the topic will be something completely different, under the umbrella of "**Challenges on transparent/tracing paper,**" a topic we look forward to. Submissions must be sent by the deadline of June 20, 2023

We wish our readers all the best
Marta **Soliva-Sanchez**
Manto **Sotiropoulou**

We would like to share with you some words about how we chose this topic, Re-Used Islamic bindings

As our chosen theme is "Re-used Islamic bindings", I thought it would be interesting to launch this topic, since it is a case in which I have personally found myself in the last few years when working with Islamic manuscripts. I would like to know what others have encountered and how they have dealt with it as it is a topic to be explored and sometimes it can be problematic because you are confronted with an action from the past that today is part of the history of the document.

Marta **Soliva-Sanchez**

Although Islamic bindings is not one in my areas of expertise, I however found that this topic could be further explored as it combines two different problems; firstly is the term "reused", which can be referred as second-use material, or "remboitage" or either the past conservation treatments by using original materials. The second aspect is "Islamic bindings", which is an area already explored separately, but never in this context.

Manto **Sotiropoulou**

***Seriš* (Eremurus) Adhesive and Its Use in Traditional and Modern Iranian Manuscripts Conservation Practice**

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ABSTRACT

With the rise of modern approaches in paper and book conservation practices in Iran influenced by Western techniques, a number of scientific investigations have been carried out to study the combination of Iranian traditional and modern conservation practice, application methods and material usage. This paper aims to present the use of local Iranian herbal Eremurus adhesive (*seriš*) in traditional restoration practice and the research projects that have been conducted to improve and modify this adhesive especially in the last few decades. This paper presents an historical review of the tradition of the use of *seriš* in manuscripts, book and paper conservation practice in Iran from 16th to 19th century (Safavid to Qajar period). Two main traditional techniques that employed the usage of *seriš* in this period are text panels and margins (*Matn va hashieh*), and mending (*vassali*) which is discussed along with the different stages of traditional conservation practice of Persian manuscripts.

Note: Many original recipes are in the form of Persian poetry. All translations are done by Professor Dr. Mandana Barkeshli with assistance from Prof. Dr. Amir H. Zekrgoo.

Introduction

In the history of Iran, the art of bookmaking was a collaboration of a number of artists and artisans working together to create the final product. In the royal courts the art of bookmaking called *kārkhāne* (workshop) allocated a group from paper makers to artists, who were experts in paper dying and sizing, as well as pigment and paint makers, layout designers, calligraphers and scribes, and finally bookbinders.

Bookbinders not only dealt with binding newly written codices, but they were also directly involved in conservation and restoration practices; repairing and binding of old manuscripts damaged through disaster (water and fire), chemical damage (acidity and light), biological factors (rodent, bookworm, termite), or simply damaged through long term usage or natural ageing. Bookbinding and mending manuscripts were not the only duty bookbinders had. Their other responsibilities include tinting and sizing papers (including burnishing and glazing), increasing paper thickness, ruling the paper, cutting, and even lining. They were also involved in making items such as bookcases, cardboard papier mâché, fans, scrapbooks, pen holders, writing pads, registers, and receipt booklets, to name but a few.¹

The terms used for bookbinding in Persian is *ṣaḥḥāfi* or *jeld-sāzi*. According to Encyclopedia Iranica the terms translate to the traditional craft of binding new books and creating decorated covers with often embossed and or painted designs, as well as repairing damaged volumes by restoring their cover and constructing new ones.² Different names

were given to the artists and individuals who dealt with bookbinding and treatment of manuscripts. The manufacturer and supplier of sheets of paper was called *warrāq*, while the one in charge of book covers was called *mojalladgar/mojalled/Jeldsāz*, all meaning “cover maker”³. In more modern times the term *ṣaḥḥāf* has mainly been used to describe a bookbinder (a term still used today). In the last half century where the profession of conservation of books and manuscripts found its position in museums and libraries as a specialized academic skill, the term *ṣaḥḥāf* started being used to describe the person who makes new book covers, and *maremat-gar* is used for conservator of historical artworks including books and manuscripts.

Tradition of conservation and restoration practice in Iran

The tradition of conservation and restoration has old roots in the history of Iran. The oldest evidence perhaps goes back to the document related to restoration and binding of a manuscript dated 1010 AH⁴ (1601-02 C.E.) obtained from Astan Quds Razavi Library. The formation of this important library and its administrative organisation also goes back to the Safavid era (16th century)⁵.

In the Qajar period, the Qurans and other manuscripts housed at the Astan Quds library, which were exposed to various damages, were being repaired. Paper restoration in ancient Iranian and Islamic culture was part of the art and craft of papermaking. *Warrāq* was the title for someone who was involved

³ *Ibid*

⁴ AH stands for ‘Anno Hegirae’, the Islamic calendar known as Hijri which is a lunar based calendar.

⁵ Roohi-Azizi et al. (2015), p. 117

¹ Afshar (2005)

² *Ibid*

in writing a document, painting illuminations, mending if necessary, and after binding, sold the manuscript himself⁶. Nāser al-Din Shāh (1848-1896), the fourth Shah of Qajar, who was the first modern Persian monarch who formally visited Europe, was also diligent in preserving books and manuscripts. In his royal library at the Golestan Palace complex, an office was allocated for the restoration of manuscripts and bookbinding. During his rule an official position with an office was designated in this profession and the person in charge was called *Sahāfbashi*⁷.

The traditional technique of restoring a manuscript that was followed for many centuries are based on two main techniques:

1. Text panel and margin technique (*matn va hashieh*)

This technique was also called *Fassāli*, the text panel was separated from the margin and replaced with another paper⁸. They were highly skilled and experienced in choosing an appropriate paper colour and texture that would not be visibly different beyond the margin line drawings (*jadwal*) (See [figure 1](#)).

The technique was used often, especially for those manuscripts where the margins suffered losses. In the Safavid era, the text panel and margin method were used to decorate books and the margin paper was darker than the text panel paper, or they used gold sprinkled paper (*zarafshān*). Preserving the order of the papers, which often do not have any markings such as page numbers, was very important. During this method of restoration, there was a risk the papers would

unintentionally be disordered, due to the restorer not recognising the back and front of the written sheet of paper. To prevent this, at the bottom of each leaf, a line was pressed onto the surface. By pressing the tip of a blunt metal tool such as a ruler, fine lines that could not be easily seen were created on the surface of the paper, making it easier to distinguish the recto from the verso of each sheet. This method is currently not used by conservators because it involves cutting around the original paper, however there are still traditional restorers who follow this tradition, such as in Astana Mubarakā Hazrat Masoumeh's workshop in Qom, as well as the Atigi Moghadam, family of restorers who believe similar paper of weight, colour and origin should be used for restoration.

2. Mending technique (*vassāli*)

If the manuscript did not need the text panel and margin technique of restoration and only had tears or losses, the mending technique used was called *vassāli*⁹. In this method, the restorer tried to patch the paper from the verso. When the area had text or inscriptions, however, the restorer made small patches between the lines or used very thin and fine paper to infill the lost areas. The repair paper used was always lighter than the original paper. First, the missing part of the manuscript was drawn on the new paper; then the edges of the original paper and the restoration paper were thinned, and the adhesive was applied on the edges. Afterwards, it was placed in a press to dry. Finally, the repair paper was sanded down so its thickness would be equal to that of the original manuscript's. (See [figure 2](#))

⁶ Afshar (2005)

⁷ Roohi-Azizi et al. (2015), p. 117

⁸ Ibid, 120

⁹ Ibid, 122

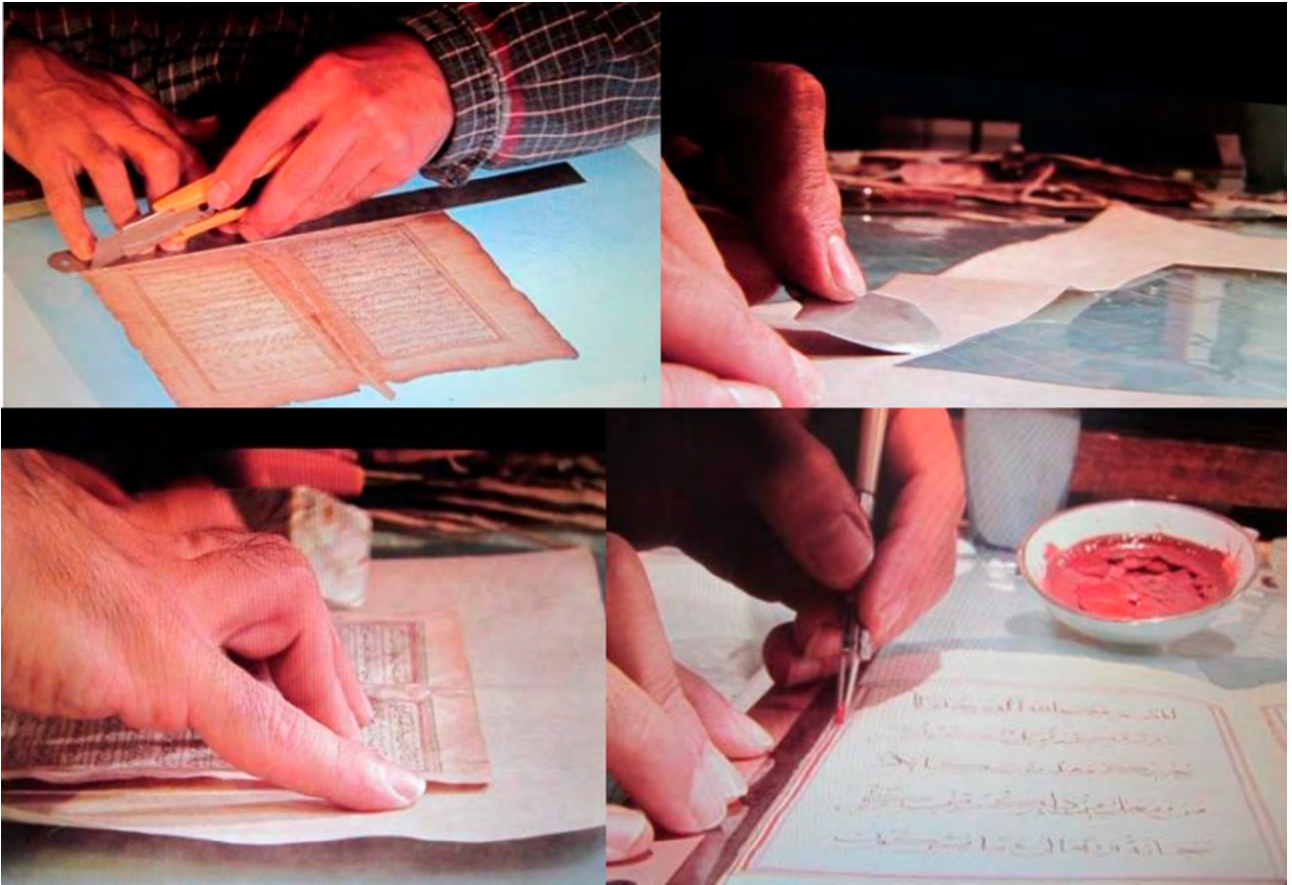


Fig. 1: The process of traditional text panel and margin technique (*matn va hashieh*).
Image courtesy of Mojdeh Roohi-Azizi

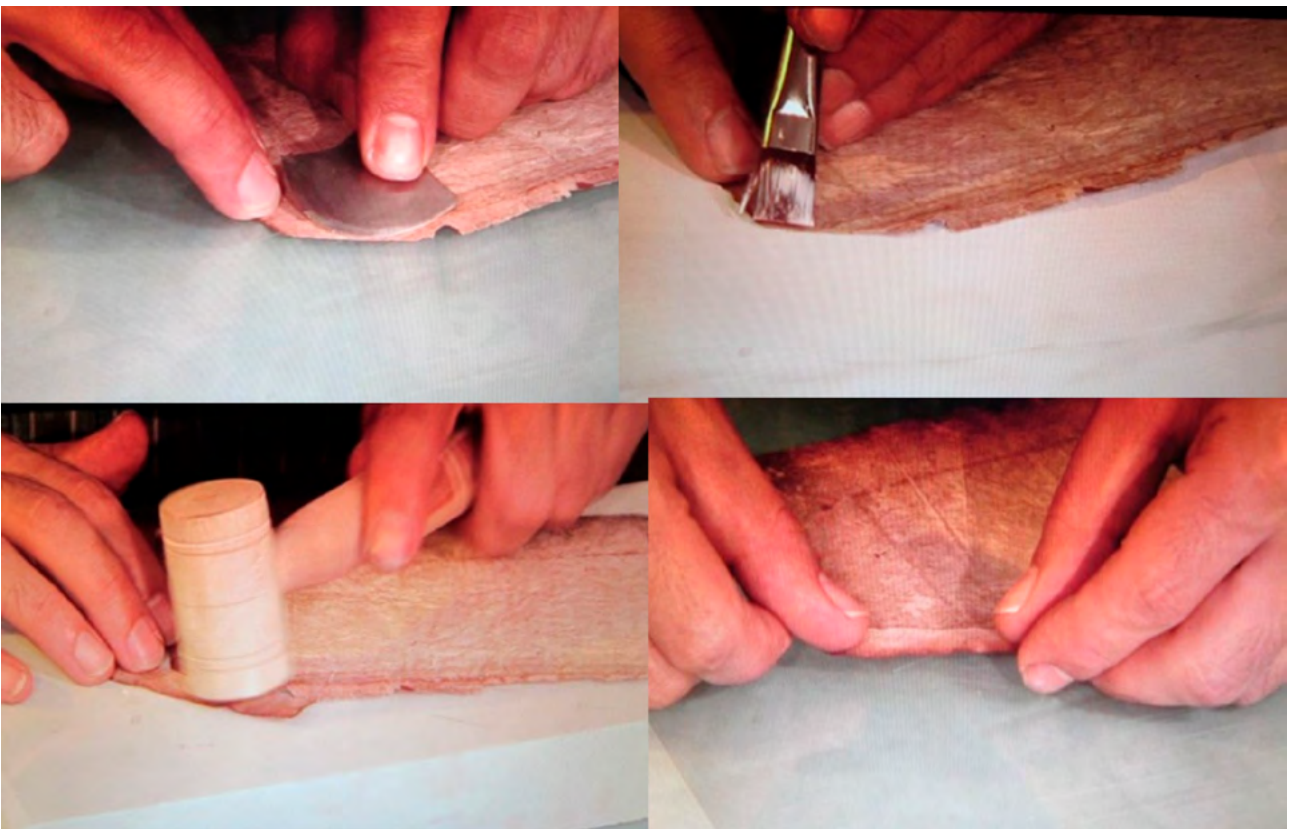


Fig. 2: The process of traditional mending technique (*vassāli*). Image courtesy of Mojdeh Roohi-Azizi

Different stages of traditional manuscript binding and book restoration

1. Selection of paper and leather

Traditional restorers of books and manuscripts had developed a natural sense of touch and a professional eye that could distinguish different quality of papers and bindings of different periods and of different regions. Some descendants of the master restorers still carry on the tradition. They usually possess valuable manuscripts like family heirlooms and their own sheets and pieces of blank or calligraphic papers that have been collected over the years, decades, and sometime centuries. These papers and leathers are often used to patch tears, fill losses and restore manuscripts and books that are commissioned to them for restoration, binding, etc.¹⁰.

Scraps of paper and leather were collected during the manufacture of every manuscript. The restorers also keep an eye on the market to find loose sheets of paper and leather belonging to lost, damaged, or destroyed manuscripts and books that have no other value except for use in restoration. They collect these fragments and keep the family business going, trying to maintain the high standards and family reputation. These restorers have a strong artistic ability that makes their restoration work outstanding. They have usually been trained in the art of calligraphy, illumination, and other fields of book decoration since childhood. They use their expertise to

reconstruct and retouch losses, such as decorations.

2. Colouring

Colouring paper was one of the stages during the construction of a new manuscript. It was also used for restoration (patches, fills, retouches, etc.). [Table 1](#) shows some of the historical treatises related to the paper dyes. (Also refer to Barkeshli 2008 and 2016).

The most important and informative treatises from the list above, are *Adab al-mashq*¹¹, *Savad al-khat*¹², *Şerāt al-Şoţur*¹³, and “*Golza-ri Safa-*”¹⁴; the latter being written in the form of verses and poetry. Historical sources from Taimurid up to the Qajar period (1785–1925 C.E.) reveal that books were advised to be made of dyed paper. Beyond aesthetic aspects, the characteristic of the paper was an important factor. While white paper was considered harmful to the eyesight, dyed paper was deemed to exert less strain on the eyes ¹⁶. In his famous treatise entitled *Golzār-e Şafā*, *Şeyrafi*¹⁷, a renowned expert of the Safavid period, writes:

کاغذ ار رنگ کنی خوبتر است کز سفیدی به بصر صد ضرر است
 ضرر چشم پسندیده مدان خامه بر کاغذ بی رنگ مران
 رنگ کن کاغذ زیبا ز نخست تا بود خط تو و چشم درست
 از تو چون زین هنری می جویم بهر تو مختصری می گویم

Dyed paper is better, for white surely harms the eyesight a hundred times; it is not favourable to hurt the eyes, to refrain from writing on

¹¹ *Isfahani* (16th C), pp.147-157

¹² *Heravī* (16th C a), pp.209-236

¹³ *Heravī*, (16th C b), pp.185-206

¹⁴ *Mašhadi* (15th C), pp.71-83

¹⁵ *Seyrafi*, (16th C), pp.239-256

¹⁶ *Barkeshli* (2016), p.50

¹⁷ *Seyrafi*(16th C), p.242

¹⁰ *Barkeshli* (1998), p. 99

uncoloured paper is wise. First, dye the paper to beauty, so that your hands and eyes remain fine; since I expect you to scale great heights in this art, I provided this short text for your sake.

Historical treatises classify the colours used for dyeing paper into two categories: primary (*mofradāt*) and secondary (*morakabāt*). Colours like yellow (*zard*), red (*sork*), safflower

red (*āl*) blue (*kabud*), green verdigris (*zangārī*), natural/flesh (*kodrang*), straw (*kāhī*), henna (*hanā'ī*) and peach (*šaftālu*) are primary colors while black (*'udī*), green (*sabz*), pink (*golgun*), kind of green (*farise*), orange (*nārenjī*), iris (*susani*) and malachite (*marmarī*) have been categorised as secondary colour. The paper was dyed to match the original manuscripts if deemed necessary.

Table 1

List of Some of the Persian Historical Treatises on Persian Paper Dye Recipes

No.	Title of the Treatises	Author	Date	Place Housed
1	Resāleh Dar Bayān-e Kāḡaḍ Morakkab va Hall-e Alvān	Anonymous	15 th C.E.	Parliament Library copy, No.1 and No. 4767 (1100 A.H/... .A.D.), Tehran, Iran
14	Resāleh-ye Joharrieh	Simi Neyšāpuri	15 th C.E.	L., Ms.Or. 7465 (Meredith Owens, p.92) n.d., fol. 381-49b; Bodleian Library, Oxford (Cat. SACHAU-ETHE, Ip. 762) dated 1122/1710, fol. 344-356b.
2	Šerāt al-Šoṭur	Soltan Ali Mašhadi	16 th C.E.	Central Library of Tehran University copy, No. 4736, Tehran, Iran and Malek National Library copy No. 4765, and No. 4126, Tehran, Iran.
3	Golzār-e Šafā	Ali Seyrafi	16 th C.E.	Paris National Library (original) No. S.P. 1656 and Tehran University Central Library (micro film), No. 3637, Tehran, Iran.
4	Kaṭ va Morakkab	Hossein Aqili Rostam-dari	16 th C.E.	Āstān Qods Ražavī copy, No. 2033, Mashhad, Iran and British Museum copy No. 3648, London, UK, and Tehran University Central Library copy (micro film) No. 4021, Tehran, Iran.
5	Ādāb al-Mašq	Soltān Aḡmad Majnun Rafiqī Heravī	16 th C.E.	Malek National Library copy, No. 4211, Tehran, Iran
	Savād al-kaṭ	Soltān Aḡmad Majnun Rafiqī Heravī	16 th C.E.	Malek National Library copy, No. 526 and Tehran University Central Library copy, No. 3522, Tehran, Iran
7	Adāb al-Mašq	Bābā Shāh-e-Išfahānī	16 th C.E.	Malek National Library, copy No. 526, and No. 2284, Tehran, Iran, and Āstān Qods Ražavī Central Library copy, No.130, Mashhad, Iran.
8	Favāyed al-koṭuṭ	Mohammad Ibn-e Dust Mohammad Boḡāri	16 th C.E.	Bukhara Library copy, No. (2617) 460 (331), Bukhara, Uzbekistan.
9	Resālih Dar Bayān-e Tariqeh-ye Sāḡtan-e Morakkab va Kāḡaḍ-e Alvān	Anonymous	16 th C.E.	Malek National Library copy, No. 2870, Tehran, Iran
10	Majmu' al-Šanāye'	Anonymous	16 th C.E.	Central Library of Tehran University copy, No. 3875, Tehran, Iran Library of Ayatullah Marashi Najafi copy, Qum, Iran, No.4917. Library of Islamic Parliament of Iran, No.15617, Tehran, Iran
11	Bayāz-e Khošbu'ī	Anonymous	17 th C.E.	India Office copy, no. 2784: Cat. ETHE
12	Resāleh-ye Šahāfi	Seyyed-al Sādāt Seyyed Yusef Hossein	18 th C.E.	Madras Government Library copy, No. 437. Madares, India.
13	Resāleh-ye khošnevisī	Anonymous	18 th C.E.	Abdul Muqtadir copy, o. HL. No. 1066, 36 fol.: Cat. XI): Ms. Patna.

No.	Title of the Treatises	Author	Date	Place Housed
15	Morakkab Sāzi va Jeld Sāzi in Kašf al-Šanāye ⁶	Ali Hosseini	19 th C.E.	Tehran Central Library, No. 2261 and Ayatollah Marashi Najafi Library, No. 4917, Qom, Iran
16	Resāleh Dar Ma'refat-e Kāḡaḡ-e Alvān	Anonymous	19 th C.E.	West Hamedan School Library copy, No. 5344, Hamedan, Iran.
17	Resāleh Dar Bayān-e Rang Kardan-e Kāḡaḡ	Anonymous	19 th C.E.	Kānqah Ne'matollāhi Library copy. No. 304, Iran.
18	Resāleh Dar Bayān-e Kaṭ va Morakkab va Kāḡaḡ va Sāktan-e Ranghā	Anonymous	19 th C.E.	Malek National Library copy, No. 4211, Tehran, Iran.

3. Paper sizing

'Sizing' (*āhār*) paper is a process of preparing the surface of the paper to make it suitable for writing, illuminating, or painting on. After a sheet of paper has been formed and dried, the cellulose fibres continue to absorb water strongly unless it has been 'sized', i.e., impregnated with a substance such as starch, or were burnished extensively. There are differ-

ent techniques available for sizing paper depending on the requirements, such as soaking or applying one or several layers of sizing material on the paper surface with the help of a soft brush¹⁸. Based on the Persian historical treatises studied, papers were almost always sized and burnished in Persia to obtain a smooth surface. Table 2 shows some of the historical recipes related to paper sizing. (Also refer to Barkeshli 2003, and 2015).

Table 2

List of Some of the Persian Historical Treatises on Persian Paper Sizing Recipes

No.	Title of the Treatises	Author	Date	Place Housed
1	Bayan al-sana'at	Habish Teflisi	12 th C.E.	Tehran Central Library, Tehran, Iran and Libraray of Hagia Sophis copy, Istanbul, Turkey
2	Resāleh Dar Bayān-e Kāḡaḡ Morakkab va Hall-e Alvān	Anonymous	15 th C.E.	Parliament Library copy, No.1 and No. 4767 (1100 A.H/... A.D.), Tehran, Iran
3	Resāleh-ye Joharrieh	Simi Neyšāpuri	15 th C.E.	L., Ms.Or. 7465 (Meredith Owens, p.92) n.d., fol. 381-49b; Bodelian Lib., Oxford (Cat. SACHAU-ETHE, Ip. 762) dated 1122/1710, fol. 344-356b.
4	Šerāt al-Šoṭur	Soltan Ali Mašhadi	15 th -16 th C.E.	Central Library of Tehran University copy, No. 4736, Tehran, Iran and Malek National Library copy No. 4765, and No. 4126, Tehran, Iran.
5	Golzār-e Šafā	Ali Seyrafi	16 th C.E.	Paris National Library (original) No. S.P. 1656 and Tehran University Central Library (micro film), No. 3637, Tehran, Iran.
6	Kaṭ va Morakkab	Hossein Aqili Rostam-dari	16 th C.E.	Āstān Qods Razavi copy, No. 2033, Mashhad, Iran and British Museum copy No. 3648, London, UK, and Tehran University Central Library copy (micro film) No. 4021, Tehran, Iran.
7	Adāb al-Mašq	Bābā Shāh-e-İsfahānī	16 th C.E.	Malek National Library, copy No. 526, and No. 2284, Tehran, Iran, and Āstān Qods Razavi Central Library copy, No.130, Mashhad, Iran.

¹⁸ Barkeshli, (2003), p. 9-16, & (2015), p. 199

No.	Title of the Treatises	Author	Date	Place Housed
8	Favāyed al-koṭuṭ	Mohammad Ibn-e Dust Mohammad Boḳāri	16 th C.E.	Bukhara Library copy, No. (2617) 460 (331), Bukhara, Uzbekistan.
9	Resālih Dar Bayān-e Tariqeh-ye Sāktan-e Morakkab va Kāḡad-e Alvān	Anonymous	16 th C.E.	Malek National Library copy, No. 2870, Tehran, Iran
10	Haliat-al ketab in Majmu' al-Ṣanāye'	Anonymous	16 th C.E.	Central Library of Tehran University copy, No. 3875, Tehran, Iran Library of Ayatullah Marashi Najafi copy, Qum, Iran, No.4917. Library of Parliament of Iran, No.15617, Tehran, Iran
11	Resāleh Dar Bayān-e Kaṭ va Morakkab va Kāḡad va Sāktan-e Ranghā	Anonymous	19 th C.E.	Malek National Library copy, No. 4211, Tehran, Iran.

In his treatises *Ādāb al-Mašq*¹⁹, *Rasm al-Ḳaṭṭ*²⁰ and *Savād al-Ḳaṭṭ*²¹, Soltān Aḥmad Majnun Rafiqi Heravi advises the use of soft, smooth and even paper to write or draw on.

Soltān Aḥmad Majnun Rafiqi Heravi²² in his treatise *Ādāb al-Mašq* writes:

وز عشق هوای مشق داری
بریان و لطیف و صاف و هموار

*peerless boy that has love in your heart
and from this love you desire to write
bring a fresh new paper
which is crisp, thin, pure, and even.
peerless boy that has love in your heart
and from this love you desire to write
bring a fresh new paper
which is crisp, thin, pure, and even.*

Three elements were involved in the sizing process: a base (*taḳte*) to spread paper on it during the sizing process, sizing substance (*āhār*) to apply on the paper to smooth the paper fibres, and burnishing tools (*mohre*) to

make the sizing adhere to the paper fibres and make the paper even and ready for writing on. According to medieval historical treatises the sizing materials were categorised into vegetable and protein base. According to historical recipes proteinaceous materials was

fish glue (*sirišum-e māhi*) and vegetable based sizes were starch paste

ای طرفه پسر که عشق داری
رو کاغذ طرفه ای بدست آر

derived from rice or wheat, vegetable gum: gum arabic (*samg-e arabi*), emerus/asphodel (*seriš*), gum tragacanth (*katirā*); mucilage from plants and seeds: Rice mucilage (*lo'āb-e berenj*), fleawort seed (*espāghol*, *esfarze*, *qetūnā*), cucumber seeds (*toḳm-e kiār*), melon seeds (*ab-e toḳm-e khiārein*), marshmallow mucilage (*lo'āb-e keṭmi*), mucilage from myrtle seeds (*toḳm-e mord*); fruit juices: juice of a sweet melon (*ḳarboze*), grape syrup (*širey-e anḡur*) and sugar syrup (*āb-e nabāt-e mešri*)²³.

4. Burnishing

After the papers were sized, either through application of the sizing agent on both sides

19 Heravi (16th C a), p. 217

20 Heravi (16th C b), p. 166

21 Heravi, (16th C c), p. 194

22 Heravi (16th C a), p.217

23 Barkeshli, (2003), pp. 9-16, & (2015), p. 199

of the paper surface, or dipped in the sizing solution, the papers were allowed to dry, at which point they were burnished. This is known as *mohre-kardan*. A number of burnishing tools were also employed, such as agate stone (*'aqiq*), jade (*yašm*), ivory (*'āj*), glass (*zejāj*), crystal (*bolur*) and shell (*jis*)²⁴.

To make fragile paper strong enough, reduce the fluffiness of the paper structure and make the surface of the paper smooth enough to write on, Mohammad Boḳāri also recommends the techniques for sizing paper in his work *Favāyed al-Ḳoṭuṭ* in details:²⁵

و دیگر طریق مهره کشیدن آن است که اولاً تختۀ مهره پاکیزه می باید و شیشه او پاکیزه و بی گره و بی رگ می باید. و مهره را اعتدال باید کشید نه سخت و نه سست. و باید که رخی و خطی در کاغذ نباشد و اگر باشد نماند. و از هر طرفی که مهره کشیدی با آن طرف دیگر را بر بالای او باید کشیدن تا هموار و به یک منوال آید.

And the technique for burnishing is that the wooden board should be clean, and the glass used for burnishing should be clean and smooth. Burnishing tool should be applied moderately, not strong nor weak and it should not make any trace of line or cleavage on paper. To make paper even and homogeneous, burnishing process should be done on both sides.

مهره کاغذ آنچنان باید که رخ رخ بر او نه بنماید

Burnishing process should be done in a way that it does not cause cleavages on the paper surface

و دیگر بعد از این که مهره کشیدی، باید که آن کاغذ را در ته تختۀ سنگی ماننی چندان روز که گذشت بعد از آن گرفته به او کتابت کنی که بسیار خوش می شود. و اگر خواهی که الحال به همان کاغذ تازه مهره نویسی، باید که در آن کاغذ دم اندازی. همچنین که به حکم کاغذ مذکور می گردد و نیز خوش قلم می شود.

Moreover, after burnishing the paper should be kept under a flat stone for a few days before writing on it and in this way the writing will come out nice. However, if you desired to write immediately after burnishing, the paper needs to be aired. In this way the paper will also become suitable to write on, and calligraphy will be beautiful on it.

5. Preparation of adhesive

In traditional restoration, preparation of adhesives was a very important stage as it was used for restoration as well as binding of new manuscripts. The traditional adhesives used were namely emerus (*seriš*), wheat starch, and flour paste²⁶.

a. Emerus (*seriš*)

It is a plant from the *Liliaceae* family and has thick and glossy hairs. The root of the plant is dried and ground into a powder. Then by adding water to it, the adhesive is obtained. Making the adhesive requires extreme skill

²⁵ Boḳāri (16th C.E.)

²⁶ Roohi-Azizi et al. (2015), p.123

²⁴ Ibid

and experience, because the strength of adherence of the paste will depend on its concentration. When adding *seriš* powder to water, the mixture should be stirred thoroughly so that the water penetrates the particles to swell them²⁷.

In present day Iran, *seriš* is used in traditional bookbinding and restoration workshops, but not in conservation labs and museums, for binding, infilling, and mending manuscripts. Different types of work require different concentrations of the adhesive made. According to Atighi Moghadam and traditional restorers who use *seriš*, they consider this adhesive to be very compatible with paper since it is reversible and can be removed with minimal moisture. For this reason, it has been used for many centuries and continues to be used today.

b. Wheat starch

A general term for starch *nešāste* is mentioned in a number of Persian medieval historical treatises without specifying whether it is rice or wheat starch. Most probably the term is used for wheat starch as Biruni²⁸ specifically referred it to wheat and mentions that the origin of the term “*našāsta*” or “*našā*” (as its abbreviation) is Persian. Jamali-ye Yazdi in *Farrokhnameh* has also mentioned wheat and its medical usage, and specifically pointed out that starch can be made out of it²⁹.

Wheat is also mentioned in detail in *Ḳaṭṭ va Morakkab* by Hossein Aqili Rostamdari³⁰ and *Golzār-e Šafā* by Ali Seyrafi³¹. In his recipe, Hossein Aqili Rostamdari describes the technique and highlights the point that the application of sizing on paper should be with a cotton ball followed by applying a moist cotton ball over the surface to smooth it:³²

چون خواهد که کاغذ را آهار کنند باید که اول شیر گندم بگیرند و صاف کنند و بعد از آن بیزند. و چون آهار پخته شد تخته بیاورند و بر بالای آن تخته نمدی یا کرباسی بیندازند و آهار را در قدحی ریزند و یک قدحی دیگر آب در پیش هم بگذارند و بعد از آن اندکی آهار از پنبه بردارند و بر آن چیز مالند، بعد از آن پنبه دیگر از آب تر کنند فی الحال بر آن مالند و بیندازند.

To size a piece of paper, take some wheat starch, filter it, and then cook it to make a paste. Then take a wooden board and cover it with felt (namad) or a muslin cloth. Take two bowls; pour the starch into one and some water into the other. Moisten a ball of cotton with starch and rub it over the paper. Finally, take another piece of clean cotton ball, moisten it with water and rub it over the starched paper. The paper can be sized this way.

In the historical recipes the term *nešāste* is not mentioned for making size from rice and mainly the process is described to make size from a rice mush made from cooking rice.

The use of starch paste is still popular in some workshops, such as restoration workshops of Astan Quds Razavi where wheat starch is used for the repair of papers that are

supported by cloth such as maps and large papers with cloth lining. Wheat starch is boiled and cooked to make a paste, and a spoonful of glycerine is mixed in to increase its flexibility³³.

²⁸ A Biruni (11th C), p.966

²⁹ Yazdi(12th C), p. 324

³⁰ Rostamdari (16th C), p. 340

³¹ Seyrafi (16th C), p. 249

³² Rostamdari(16th C), p. 340

³³ Roohi-Azizi et al. (2015), p.124

²⁷ Ibid, pp.123-124

C. Flour paste

What distinguishes the starch from the flour is the presence of gluten protein in starch. The key difference between flour and starch is that flour is powder made by grinding raw grains whereas starch is a tasteless, odourless white solid substance at room temperature containing carbohydrate with carbon, hydrogen and oxygen atoms extracted from carbohydrate-rich food like potatoes, corn and wheat. Flour contains a high proportion of starch and goes through minimal processing of milling which traditionally involves grinding grain between stone or steel wheels. Whereas starch comparatively must go through a lot of processing; gluten in flour is washed out with water, and then gluten-washed water is allowed to stand for precipitation, and finally the starch is precipitated which is white in colour and smooth. Starch is not soluble in cold water, however when it is heated it will turn to a gel-like substance at temperatures of 60–80° C, and it will be transformed into viscous and white starch paste.³⁴

When wheat starch is dried it forms a strong bond with paper and it has historically been used as a paper sizing agent, and as primary adhesive for conservators for hinging, mending, lining and reinforcement.

6. Bookbinding

The recent publication of Karin Scheper³⁵ has given invaluable information and deeper understanding of Islamic bookbinding, their methods, materials, and regional varieties. According to her there are five major historical sources which is found describing the making of Islamic books and their bindings

in particular. These are Ibn Badis (d. 1062)³⁶, Bakr al-Ishbili (d. 1231), Al-Malik al-Muzaffar (d. 1294), Ibn Abi Hamidah (fifteenth century), and al-Sufyani (treatise is dated 1619).³⁷ In brief the production and process of Islamic Bookbinding consists of two phases: 1) The preparation of the bookblock 2) The preparation of the cover.

The process of these two major steps evolved over time and varied from region to region, depending on the availability of materials and the techniques of application.³⁸ The above mentioned five historical treatises all have a similar text structure.³⁹ They all begin with introductory remarks on the crafts followed by the description of tools, making of adhesive, preparation of the gatherings, stitching, spine preparation, mounting the binding on the text block, the board and covering materials preparation, and finally the cover decorations.⁴⁰

The art of bookmaking in Persia has experienced significant changes and development throughout history. These developments with most significant creativity and innovation continued from early Islamic centuries to the 19th century during the Qajar era.

Bookbinding in Persia not only was made to serve the protection of the manuscripts but also to serve aesthetically as part of the cultural identity. For this, a variety of innovations in bookbinding techniques were created using different materials and artistic designs with fine and elaborate patterns and skilful execution. With increasing contact with the West during the Qajar period, diversity and

³⁶ *d. stands for death i.e. the date the person in question has died.*

³⁷ *Ibid.*, 146.

³⁸ *Islamic Arts Museum Malaysia (2017)*

³⁹ *Scheper (2015)*, p.168

⁴⁰ *Islamic Arts Museum Malaysia (2017)*

³⁴ *Banik/Bruckle (2011)*, p. 605

³⁵ *Scheper (2015)*

innovation appeared from renowned master artists, whose differing styles and tastes were influential. Although binding methods and materials have changed across the ages, leather was most commonly for book covers, mainly goat leather (*timajj*), sheepskin (*mish-en*) and sometimes shagreen, lacquered / papier-mâché (lacquered covers featuring painted designs) and cloth (fabrics such as brocade cloth, flannel, satin, velvet, calico, chintz, or denim).

Persian bookbinding has its own unique characteristics. The three main bookbinding innovations that have had their origins attributed in Iran are tanning leather with minerals⁴¹, the invention of the book flap, and lacquer painting. During the Seljuk, Taimurid, Safavid and Qajar periods we can witness significant developments in Persian bookbinding. Iraj Afshar (1925-2011) who was an eminent bibliographer and historian in the field of Persian studies and consulting editor of Encyclopedia Iranica at Columbia University has described the materials, techniques and varieties of Persian bookbinding which is briefly presented here in the following sections⁴². According to him we can identify Persian bookbinding through six main categories based on materials and techniques:

- 1) Stamping or burning (*Suḵt* or *sukṭa*)⁴³,
- 2) Mosaicing (*Mo'arraḡ*)⁴⁴,
- 3) Beating or striking (*Ẓarbi* or *kubida*)⁴⁵,

⁴¹ Haldane (1989)

⁴² Afshar (2005)

⁴³ designates highly ornate covers in which elaborate designs are cut out on a separate piece of leather, which is then adhered into the openings carefully cut out of the mildly scorched and browned cover. To make the designs stand out, the surface under the ornamental leather piece was tinted orange, red, green, or blue.

⁴⁴ is the leather cover of the *sukṭa* type of binding, with the difference that the various designs are inlaid and patterned like mosaic work.

⁴⁵ a book cover bound in leather featuring quarter

- 4) Gilding (*Ṭelāpuš*)⁴⁶,
- 5) Lacquering (*Rawḡani*)⁴⁷,
- 6) Cloth & Leathering (*Maḡzi*)⁴⁸.

Each of these types of bookbinding has its own characteristics and techniques of application. For example, in stamping or burning (*Suḵt* or *sukṭa*), which is highly ornamented, designs are cut out on a separate piece of leather, which is then adhered into the openings carefully cut out of the mildly scorched and browned cover. To make the designs stand out, the surface under the ornamental leather piece was tinted orange, red, green, or blue⁴⁹ (See [figure 3](#)).

According to Afshar different stages were carried out in Persian bookbinding. It starts with drawing straight lines to form rectangular frames around the writing on a page, sometimes in two columns (*Jadwal-sāzi* or *jadwal-bandi*); followed by stitching of the form together with needle and thread (*joz-wa-bandi* or *korrāsa-bandi*); then fastening together of the quires of the book from top and bottom by thread and joining them with the front and back covers (*širāza-bandi*). In this stage, multi-coloured thread for aesthetic reasons were sometimes used. The next stage was paring of the leather, especially

medallion, pendant, and medallion affixed into depressions created by pressing the ornament into the dampened leather. Sometimes these designs were trimmed with emulsified gold.

⁴⁶ a kind of gilded ornamentation denotes bindings with leather covers featuring incised and somber bindings with large parts of its ornamental designs gilded with emulsified gold.

⁴⁷ a lacquer cover placed on a papier mâché base and treated with thick layers of lacquer and tinting compounds with painting designs on it.

⁴⁸ (Also called *sejāfdār*) refers to covers made of high quality cloth (sometimes of marbled paper) with leather protective edges; it has also been occasionally used for leather covers as well, especially covers made of leather alone without cardboard stiffener. This kind of cover, which is flexible, is also called *lāyi* and *do-lāyi*.

⁴⁹ Afshar (2005)

its ends, to make it even and easier to be adhered to the cardboard. In the next step, cardboard with wastepaper for the backing of the cover was made followed by patching of torn sheets of paper and trimming their edges. Finally for preservation purposes mounting of worm- and mouse-eaten sheets of manuscript on fresh paper was carried out

Ornamentation in Persian bookbinding has its own characteristics that required different skills during different periods. The front and frequently the back of the book cov-

ers were usually both ornamented, whereas the spine was seldom given any decoration. The covers were usually gilded in the form of floral or geometrical patterns enclosing the title and authorship with calligraphic designs. Sometimes paper printed with designs and motifs like clouds and waves called *Abri* were used for adhering on and inside the cover. In all the above processes, the right adhesive and its concentration was a very important element of the bookbinding process.



Fig. 3: 16th Century Persian book cover and flap in dark brown leather in gilded technique complemented with a colourful doublure (inner cover) in light brown leather, overlaid with gold filigree work using coloured papers as background of the filigree and arranged into all-over honeycomb pattern, Islamic Arts Museum Malaysia collection, Acc. No. 2013.7.97

The link between tradition and modern conservation and restoration practice

In the Qajar period, efforts were made to familiarise traditional restorers with the European conservation practice. For this reason, in 1275 A.H./1858-59 C.E. at the threshold of Astan Quds Razavi and Naseri Dar al-Tabaeh office, the title position of “*Sahafbashi*” was given to a young man who was one of the 42

Iranian students sent to Europe to gain western conservation knowledge.⁵⁰

Molla Hossein Sahafbashi was one of the famous restorers and binder who got the title of *Sahafbashi*⁵¹ in 1290 C.E. (See [figure 4](#)). He used the method of text panel and margin (*matn va hashieh*) to restore rat-eaten holes and deficient papers, but with a paper different from the original paper of the manuscript.

⁵⁰ Roohi-Azizi et al. (2015), p.118

⁵¹ Mahboob-Farimani (2010)



Fig. 4: Molla Hossein Sahafbashi was one of the famous restorers and binders who got the title of *Sahafbashi* in 1290 C.E. (Image courtesy of Mojdeh Roohi-Azizi)

In this way the Iranian traditional restoration found a new approach of applying modern European school of thought with its refinement and elegance in paper restoration. After Molla Hossein Sahafbashi, his sons Mirza Fazalullah *Sahafbashi* and Mirza Nasrallah *Sahafbashi* who were trained and educated in the school of the father, became guardians of his legacy at the Astan Quds Razavi. The next generation of traditional restorers and bookbinders are Hossein Atighi Moghadam who continued this path with his children up to today. Traditional restoration along with modern conservation methods continued in this institution with master conservators such as Javad Rafugaran, Ramzan Ali Moqadasi (See figure 5), Hasan Fadlkah, Rajab Ali Rostami, Mohammad Hassan Masalehgu, Hassan Khatibi, Hassan Dehghanpour and Ahmad Taliban.⁵²

⁵² Roohi-Azizi et al. (2015), pp.118-119



Fig. 5: Ramzan Ali Moqadasi in his restoration workshop. (Image courtesy of Mojdeh Roohi-Azizi)

Seriš is still commonly used by traditional restorers especially in bookbinding restoration as after years of use it still retains its adhesive properties, has shown great durability and flexibility, and the manuscripts and bindings that were restored with *seriš* are still in good condition after centuries⁵³. However, there is a disadvantage of using this traditional adhesive due to the fact that the colour of *seish* is slightly yellow⁵⁴.

In the past forty decades with the rise of university graduates in the field of Persian manuscripts conservation, and bookbinders, many conservation and restoration workshops have been formed in museums and archives and private sectors. These conservators follow the ICOM code of ethics where they use minimal intervention, reversibility and using western conventional adhesives replacing *seriš* by modern conservation workshops. This started in 1355 A.H./1977 C.E. with

⁵³ *Ibid*

⁵⁴ *Ibid*

the efforts of the National Archive of Iran and with the arrival of UNESCO delegation.

The traditional restoration method was gradually replaced by modern techniques influenced by West⁵⁵ mainly using synthetic adhesives for book binding as well as adhesives such as starch paste, unsupported *Archibond*TM (acrylic adhesive), carboxymethylcellulose, hydroxypropylcellulose and methylcellulose. Of course, there are still different opinions between Iranian restorers, whilst few are still loyal to applying traditional techniques and materials. The text panel and margin method, cutting around the main paper and introducing new margins, gradually became obsolete due to its being viewed as an unethical approach in restoration.

With a long history of conservation and restoration practice in Iran, projects have been initiated among academics to link tradition and modern practice through scientific analysis. Several case studies have been carried out by academics, students, and conservation scientists to evaluate the traditional materials and techniques with intention of understanding their nature along with their advantages and disadvantages and combine traditional and modern techniques. One such project was modifying the *seriš* adhesive which will be highlighted briefly here as a conducted case study.

Case-study - eremurus (*seriš*)

The genus *Seriš* with the scientific name of *Eremurus*, also known as *Foxtail lilies* or *Desert candles*, is one of the genera of *Asphodeloideae* subfamily and traditionally classified in the *Liliaceae* family. The classification of this genus has undergone many changes so far. In

⁵⁵ *Ibid*, p. 116

a major and significant review of the division of plants in recent years - *Eremurus* has been classified as a genus of the *Xanthorhoaceae* from the *Asphodelaceae* family, with nearly 64 accepted species. It is scattered throughout the temperate zones and tropics such as large areas in Central Asia, Caucasia, Afghanistan, Iran, Pakistan, Iraq, Turkey, Lebanon, India and China^{56 57}, and its centre of diversity is in Central Asia⁵⁸.

Asphodeloideae of the subfamily of *Liliaceae* in the Flora Iranica has three genera, including *Eremurus*, *Asphodelus* L. and *Asphodeline* Reichenb⁵⁹. Seven species of *Eremurus* have been recorded in Iran⁶⁰. These plants, usually grow on rocky slopes and mountain steppes in several part of Iran and bloom in June. These plants have thick tuberous roots, which looks like a starfish (See [figures 6 & 7](#)) and accumulate a high level of glazey glucomannans and fructans. The major component of these polysaccharides is Inulin. These polysaccharides are bright-coloured, hygroscopic water-soluble compounds, giving no coloration with iodine. Maximal accumulation of fructans in *Eremurus* roots is related to early signs of extreme environmental conditions. Roots reach the maximum size and highest amount of fructans accumulation in hot and arid seasons⁶¹.

People in Iran traditionally use the plant roots to make adhesive. The roots are first dried and then pulverized. When mixed with cold water, the powder swells and forms a strong adhesive with strong flexibility and mucilaginous property. The main reason for

⁵⁶ Mabberley (1990)

⁵⁷ Wendelbo/Furse (1969)

⁵⁸ Hedge/Wendelbo(1963)

⁵⁹ Wendelbo, (1982)

⁶⁰ Smirnova et al. (2001)

⁶¹ Smirnova et al. (2001)

seriš having adhesive properties is water absorption by inulin to form a gel, and its thickness depends on the amount of inulin, the preparation method, particle size, purity, viscosity, and drying time of the adhesive. In

addition, several phenolic compounds, including anthraquinone, bi-anthraquinone and naphthalene derivatives, are present in the *Eremurus* genus roots, some of which are yellow to orange.



Fig. 6: *Eremurus* root, harvested from Binaloud mountain, Iran (Image by Nasim Koohkesh)



Fig. 7: Cross section of *Eremurus* root (left) and powder (right) - Image by Nasim Koohkesh

Historical recipes

Emerus (*Seriš*) is a plant-based adhesive with a long history to the point that the word has

been used by poets as a synonym for adhesive as seen in the verses below:

بر نجسفانم دو پر من با سریش! پرمن رستمت هم از ذات خویش

My wings are grown from the nature within I didn't attach them on with seriš.

⁶² Rūmī (13th C), Book II, Section 103

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طشت زرینم و پیوند نگیرم به سریش⁶³

زخم شمشیر غمت را ننهد مرهم کس

No one can heal the sorrowful wound inflicted by your sword
I'm a brojen gold cauldron which can not be mended with seriš

Scientists such as Razi described *seriš* as a binding agent in one of his alchemy recipes and Biruni⁶⁴ used the term to define the shoe-makers' adhesive made out of a plant's root called *sholl*⁶⁵. Besides its usage mentioned above, *Seriš* has long been used as traditional medicine in many regions. This plant is used in Turkey and Iraq to treat eye inflammation, diabetes and eczema. In China, it is used to treat rheumatism and helps with physical weakness. It is also used in the treatment of coughs, jaundice and intestinal diseases⁶⁶. The plant is also edible and in regions such as Siberia and Turkey, it is used in their cuisines⁶⁷. It is currently considered as a source of fructans with high nutritional value in the food industry; therefore various research has been performed on extraction fructans from *seriš* roots.

New botanical research has also shown that the ethanolic extract of different species of this genus has significant antibacterial, anti-inflammatory and antioxidant properties and it reduces blood sugar to a large extent.

Nevertheless, the main usage of *seriš* in Iran was as an adhesive and many historical treatises explain preparing *seriš* paste for

different purposes, including sizing material.

In three treatises, *Şerāt al-Şoṭur*⁶⁸, *Favāyed al-koṭuṭ*⁶⁹ and *Resāle dar Bayān-e Kaṭṭ va Morakkab va Kāgāḍ va Sāḳtan-e Rangha*⁷⁰ adding *eremurus (seriš)* to the starch paste have been advised in the same manner in poetry form. The eminent calligrapher Solṭān Ali Mašhadi in *Şerāt al-Şoṭur*, devoted several couplets of his treatise on the mixture of sizing using starch and *eremurus* adhesive and glazing paper by hands as follows:⁷¹

در باب آهار ساختن و کاغذ آهار کردن

ساز آهار از نشاسته کن	بشنو این ز پیر پخته سخن
اولاً کن خمیر و آب بریز	پس بجوشش دمی به آتش تیز
پس لعاب سرش به او کن ضم	صاف سازش نه نرم و نه محکم
رو به کاغذ بمال و سعی نمای	تا که کاغذ نیوفتد از جای
کاغذ خویش چون دهی آهار	مال آبی به روی او زنهار

About producing sizing material and paper sizing

Prepare the size (*āhār*) from starch,
learn these words from an old man;
First make a paste, then pour in water,
then boil this on a hot fire for a moment;
Then add some *eremurus (seriš)* to thin starch
strain it [so that it is] neither too thin nor too thick;
Spread it on paper and make sure
that the paper does not move from its place;
When you are applying size to your paper

63 Saadi (13th C), *Divan Ghazliat - Ghazal 340*

64 Biruni (11th C), p. 659

65 *Ibid. sholl* (لش): Some historians refer it to a type of Indian quince (*Cydonia indica* Spach).

66 Khorasani (1769)

67 Smirnova et al. (2001)

68 Mašhadi (15th C) p. 77

69 Boḳāri (16th C), pp. 374-375

70 *Resāleh dar Bayān-e Kaṭṭ va Morakkab va Kāgāḍ va Sāḳtan-e Ranghā* (16th C), pp. 534-535

71 Mašhadi (15th C) p. 77

Slightly moisten the paper with great care.

There is a possibility that eremurus (*seriš*) has been used in pure form without mixing with starch paste for paper size, however no particular recipe was found in the Persian historical recipes under study.

Advantages and disadvantages of *seriš*

Among the characteristics of *seriš*, we can mention the appropriate adhesive strength, reversibility in water, neutral pH, durability, low cost and ease of preparation. In addition, compared to the samples treated with other adhesives, the paper treated with *seriš* has shown the least reduction in mechanical strength after the accelerated ageing compared to the reference paper. According to Tousi, its viscosity in water is much higher than that of formaldehyde-based adhesives, which has a positive effect on its adhesion and binding power, and when it is freshly prepared, it creates a good bond with paper⁷².

Despite these advantages, *seriš* has disadvantages that have caused it to be used less in restoration workshops today; Including the fact that this adhesive is yellow in nature and leaves a coloured stain on the paper, which is not a desirable quality for an adhesive used for conservation purposes. Furthermore, due to its organic nature, it is vulnerable to microbiological attacks⁷³. Researchers have found that adhesives such as *seriš* and carboxymethyl cellulose have a high risk of being attacked by fungi such as *Cladosporium* and *Penicillium*⁷⁴. In addition, the viscosity and the adhesive strength of *seriš* solution be-

gin to decrease after a few hours of preparation; therefore, it should always be prepared and applied fresh⁷⁵.

There are enough benefits to this local adhesive that its characteristics should be analysed, and efforts should be made to restore its position in modern conservation and bookbinding and exploit its merits⁷⁶.

Conducted scientific research on *seriš*

In the last three decades, scientific research projects were conducted to study the advantages and disadvantages of *Eremurus (seriš)* through a number of institutions.

1. The first scientific research project initiated on *seriš* for the first time in 1995 was the master's thesis under the joint supervision of the author (Barkeshli) and (Shams-Azar) conducted by Adnani⁷⁷ entitled "Evaluation and modification of *Eremurus spectabilis* for the restoration purposes of cultural documents and books at Art University of Isfahan. It was found that *seriš* has all conventional adhesive advantages except its yellowish color. This research focused on colour removal from the adhesive for restoration purposes. In her thesis, Adnani investigated the effect of the solubility of the *seriš* powder in water and ethanol and examined the effect of using activated carbon in uncolouring this adhesive. Active carbon is able to absorb the colour.

However, Adnani did mention that the disadvantage of this technique is the the need to dilute the adhesive to allow for filtration and separation of active carbon particles. In addition, this method reduces the adhesion

⁷² Tousi et al. (2014)

⁷³ Samanian (2011)

⁷⁴ Moradkhani et al. (2011)

⁷⁵ Koohkesh et al. (2019)

⁷⁶ Ibid

⁷⁷ Adnani (1995)

strength of *seriš*. To solve these problems, the researcher proposed to concentrate the uncoloured adhesive. Despite the issues mentioned, the chemical and physical properties of modified paste were satisfactory when compared to the unmodified one. In her experiments Adnani states that a 5% ethanol solution is suitable for dissolving *seriš*, and the solution showed a better resistance to fungi.

2. The second research project was carried out by Moradkhan in 2011 in a master's thesis entitled "Investigating the side effects of restoration adhesives on Iranian paper works", where effects of four common conservation adhesives on paper through accelerating ageing were investigated; starch, *seriš*, carboxymethyl cellulose (CMC) and texcryn (styrene acrylic copolymer emulsion). The acidity and mechanical properties of treated paper, the degree of reversibility of the adhesive, and the amount of colour change caused by these adhesives on machine-made and hand-made papers (before and after accelerated ageing) were all examined. It was concluded that all adhesives interfere with the chemical properties and mechanical resistance of paper; however, in similar conditions the effects can be different for machine made and handmade paper.

This research showed that *seriš* had better reversibility than starch, CMC and texcryn in addition, compared to the samples treated with other adhesives, the samples of handmade paper treated with *seriš* showed the least decrease in mechanical strength after accelerated ageing. *Seriš*, however, caused the greatest increase in acidity in both handmade and machine-made paper samples.

3. In an article presented by Samanian at the Copenhagen paper conservation conference, in which various adhesives used at

The Library of Congress (Iran) were criticised, for the first time, *seriš* adhesive was introduced by mentioning its advantages and disadvantages in an international forum in the field of restoration. In this article, by analysing the problems caused by synthetic adhesives at The Library of Congress (Iran), the author suggested using traditional materials, including *seriš*, in conservation and restoration projects⁷⁸.

4. The next research project was another attempt to remove the yellow colour of *seriš*. This research was conducted by Golbon⁷⁹ in 2013 for a master's degree, investigating the use of nanotechnology to promote the herbal adhesive, *Eremurus spectabilis (seriš)*, for manuscript protection and repair in Faculty of Conservation and Restoration, Tehran University of Art. In this research, Golbon used carbon nanotubes for colour removal of *seriš* adhesive and compared the results with the outcome of Adnani's research on the use of active carbon in colour removal. The influence of pH of solution and the effect of increasing the contact time of the adsorbent with the solution have been studied in this research. Golbon found this material suitable for removing colour from adhesive while maintaining its adhesion; however, it has been found that it is challenging to separate carbon nanotubes from the sticky solution through centrifuging.

5. Tousi⁸⁰ and his colleagues conducted research in 2014 on the effect of the use of *Eremurus (seriš)* powder on the mass accumulation coefficient of chipboard. While this research is not relevant to conservation practice, it does relate to the characteristics of

⁷⁸ Samanian (2011)

⁷⁹ Golbon (2013)

⁸⁰ Tousi et al. (2014)

the adhesive. The adhesion properties and viscosity of *seriš* were compared with formaldehyde-based adhesive, which is used in the wood industry. They state that the adhesion strength of *seriš* is related to its viscosity which in turn is connected to the method of preparation and how long after the preparation it has been applied. Results of the experiments showed the viscosity of *Eremurus* was higher which leads to higher strength and binding properties when compared formaldehyde-based adhesives.

6. The last research project was another master's thesis which was carried out by Koohkesh⁸¹ in 2018 at Faculty of Conservation and Restoration, Tehran University of Art, titled "Possibility of Elimination of Colouring Compounds from *Eremurus* Paste for Paper and Manuscript Restoration". She investigated the possibility of removing colouring compounds from *Eremurus* paste using solvent extraction method. Solvent extraction is the most common method of extracting polysaccharides from plants. Polysaccharides that are completely or relatively soluble in water and form gels or sticky solutions can be extracted with hot or cold water, but they are not very soluble in solvents that are less polar than water and hence, precipitate. Therefore, the most common method of separating these compounds from aqueous extracts is to precipitate them by adding a non-polar solvent that can be mixed with water (such as ethanol).

Koohkesh extracted the paste from fresh roots as many enzymatic reactions occur in roots after harvesting and during the traditional air-drying method, which affected the colour negatively. She applied the method of

stabilisation of enzymes by boiling the roots in 70% ethanol, by which the enzyme is inactivated and many colouring materials and low molecular-weight substances are removed⁸². Afterwards the *seriš* paste was prepared in the highest yield of fructan extraction (temperature and extraction time) using the previous studies on extracting fructans from *seriš* root⁸³. The researcher then precipitated the fructans by adding ethanol and separated them from the solution and other components, including colouring agents, which are soluble in the non-polar solvent and remain in the solution. She also used freeze drying method to dry the extracted sticky material as it has been found that this method provides a higher quality of fructan than fructan dried through vacuum drying or heating. In addition, freeze-dried fructans have the highest solubility and the lowest amount of red and yellow tones. At the same time, freeze-dried particles have the most crystalline form and have more thermodynamic and chemical stability.

The extracted adhesive was applied on paper and compared to wheat starch, CMC and traditional *seriš* paste after accelerated ageing. The analyses showed that the extraction method with ethanol is an effective method to eliminate colour from the adhesive. The adhesive is more suitable for paper restoration than traditional *seriš* paste in terms of colour, acidity and durability. This method does not impact the adhesion strength of the adhesive. In addition, extraction by solvent decreased its acidity; modified adhesives showed a higher pH value compared to reference paper and other samples treated with other adhesives.

Koohkesh released her research re-

⁸¹ Koohkesh (2018)

⁸² Smirnova et al. (2001)

⁸³ Pourfarzad et al. (2014)

sults in a conservation journal⁸⁴. She claimed that coloured compounds can be removed from the *seriš* paste through extraction via ethanol, a non-polar solvent. The extracted adhesives had significantly improved in terms of lightness and colour compared to the traditional *seriš* powder. This approach on the one hand was helpful in removing colour, and on the other hand, proved effective in prohibiting the pH of the adhesive from decreasing. Fourier Transform Infrared (FTIR) analysis proved the effectiveness of the method in removing chromophores. It led neither to paper acidifying nor to damaging the polymeric structure of paper after accelerated ageing. Furthermore, stabilising the enzyme using 70% boiling ethanol before drying the roots or extracting the adhesive was also an effective method for inhibiting enzyme operation and preventing the creation of new chromophore by enzymatic molecule degradation.

In another paper, Koohkesh (2019) stated that enzyme stabilisation through boiling the fresh roots in 70% ethanol, is an effective method in increasing and maintaining the consistency, viscosity, and adhesion of the paste. Analyses proves that the most effective method to improve the adhesion and viscosity of *seriš* is extracting the material from the roots of *seriš* with stabilized enzyme activity. This method does not impact the quality and strength of the adhesive; moreover, analyses show that this adhesive is considerably less vulnerable to microorganism invasion compared to the traditional *seriš* adhesive⁸⁵.

Conclusion

The present study gave an overview of the long history of traditional restoration of paper manuscript and bookbinding in Iran from 16th to 19th. Our study showed that due to this long history of tradition there has been a need to combine traditional Iranian restoration practice with modern techniques of conservation practice and scientific approach. One of the most important subjects that is taken place with this intention is on *Eremurus spectabilis* (*seriš*). The scientific research projects that have been developed for the last three decades on *Seriš* to improve and modify its properties to be used in modern manuscript conservation practice have been reviewed. It was found that all the research projects confirmed that *seriš* has a great advantage including appropriate adhesive strength, reversibility in water, neutral pH, durability, cost effectiveness and ease of preparation. Despite the mentioned advantages it was found that *seriš* has its own shortcomings. Through several scientific research that was conducted on improving and modifying, removing its yellow colour, and improving viscosity and adhesive strength, it was confirmed that this native material can restore its position again as a main adhesive to be used in conservation and restoration of manuscripts and bookbinding practice of Iran.

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⁸⁴ Koohkesh et al. (2020)

⁸⁵ Koohkesh et al. (2019)

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Zekrgoo has been researching traditional Persian writing inks for over a decade and since 2015, he conducted several Persian ink making workshops for Islamic Museum Australia, Australian Institute for the Conservation of Cultural Material (AICCM), the University of Melbourne, and the Bodleian Library, University of Oxford. His research interests include artist materials reconstruction, and the transference of knowledge through oral history.

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Between 2017 and 2019, Koohkesh participated in projects at the Malek museum (Tehran, Iran) for manuscripts conservation, and the restoration and conservation of items obtained from the Khazineh Hill historical graveyard (Qasreshirin, IRAN).

Koohkesh has patented a method to improve Serish (*Eremurus*) adhesive, a traditional Persian herbal adhesive, strongly adherent; however, it leaves yellow-brown stains on paper. Modifying the adhesive helps eliminate the undesirable colour and improves other adhesive qualities, including the acidity and viscosity of the adhesive, and does not af-

fect its strength.

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