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Clinical Applications, Active Components and Mechanisms of Haemostatic Effects of Charred Chinese Medicines

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Abstract: Charred traditional Chinese medicines have been used to stop bleeding since ancient times. To date, they are often applied to treat purpura, metrorrhagia, upper gastrointestinal bleeding, postoperative hemorrhage of mixed hemorrhoids, and hemorrhoids bleeding. Conventional oral decoction is still a predominate application form. It is noteworthy that a new and original application form of charred herbs has occurred in the treatment of upper gastrointestinal bleeding. Different from the conventional oral decoction, the micron-sized rhei radix et rhizome carbonisatus was sprayed on the surface of the lesion through gastroscopy to stop upper gastrointestinal bleeding. Active tannins, calcium ions, flavonoids and anthraquinones play a role in a part of charred herbs to stop bleeding. The emergence or increase of active components may lead charred herbs to significantly better haemostatic effects than uncharred ones, especially the emergence of activated carbon and novel carbon dots. This underlines a big need to char herbs at first before their clinical use. It leads to a new issue how to char herbs properly for maximum active components, which is related to the quality control of charred herbs. Hence, the optimum charring methods should be explored in depth for different herbs in the future. Furthermore, modern research indicates the haemostatic mechanisms of charred herbs are related to their ability to activate coagulation pathways, enhance platelet systems and/or inhibit fibrinolysis systems.

Keywords: Charred Herbs, Carbonized Herbs, Haemostatic Effects, Stop Bleeding, Carbon Dots

1. Introduction

Traditional Chinese medicines have made important contributions to the health care of Chinese people. However, they need to be processed properly for better effects before clinical use. A special process, charring herbs to carbon, has been applied to stop bleeding in clinic for a long time in Chinese history. To date, they are still used extensively to a various of bleeding diseases. A lot of modern pharmacological animal experiments proved the haemostatic effects of charred herbs. Nevertheless, the scientific reason why the herbs need to be charred in advance to stop bleeding is still unclear. It has been intriguing an increasing number of researchers. Their research focuses on the change of active components after herbs charred and the haemostatic mechanisms of charred herbs. Therefore, our review is aimed to summarize and analyze the clinical applications, active components and haemostatic mechanisms of charred herbs, and further explore the scientific reason of the question above.

2. Clinical Applications

The applications to stop bleeding of charred medicinal materials have a very long history in China. They were recorded in a series of distinguished works from Qin Han dynasties to date (Table 1). The earliest records can be traced back more than 2000 years ago in *Fifty-Two Prescriptions, Sheng Nong's Herbal Classic* and *Synopsis of The Golden Chamber.* Since then, nearly all past dynasties have inherited and developed the application of charred medicine. The latest Chinese Pharmacopoeia (2020 edition) also confirmed the

usage of charred herbs to stop bleeding. There are 27 items recorded in total, five out of which are recorded outstandingly, including cirsii japonici herba carbonisata, crinis carbonisatus, schizonepetae herba carbonisata, schizonepetae spica carbonisata, dryopteridis crassirhizomatis rhizoma carbonisatum (Figure 1).

Table 1. *Respective records of haemostatic herbs.*

dynasty	distinguished works	Respective records of haemostatic herbs
Qin and Han	*Fifty-Two Prescriptions (Wushier Bingfang)*	char human hair to stop bleeding
	Sheng Nong's Herbal Classic (Shennong Bencao Jing)	char shellfish to stop bleeding
	Synopsis of the Golden Chamber (Jingui Yaolue)	char vaccaria segetalis, sambucus chinensis and cortex mori to stop bleeding
Liang	*Famous Doctors' Records (Mingyi Bielu)*	char human hair to stop bleeding
Tang	*Thousand-Golden-Prescriptions for Emergency (Beiji Qianjin Yaofang)*	char cornu antelope to treat postpartum hemorrhage
	Newly Revised Materia Medica (Xinjiu Bencao)	char human hair to stop bleeding
Song	*Classified Materia Medica (Zhenglei Bencao)*	char sheep shank to stop intestines bleeding
Yuan	*Miraculous Book of Ten Prescriptions (Shiyao Shenshu)*	*Ten Ashes Powder:* char cirsii japonici herba, cirsii herba, platycladi cacumen, nelumbinis folium, imperatae rhizoma, rubiae radix et rhizoma, rhei radix et rhizoma, gardeniae fructus, moutan cortex, trachycarpi petioles to stop bleeding
Ming	*Compendium of Materia Medica (Bencao Gangmu)*	char vaccaria segetalis, sambucus chinensis and cortex mori to stop bleeding
Qing	*The Source of The Herbal Classic (Benjing Fengyuan)*	char schizonepetae herba to treat postpartum hemorrhage
	Seeking Truth from Herbal (Bencao Qiuzhen)	char schizonepeta tenuifolia, gardenia jasminoides ellis or phellodendron amurense to stop bleeding
Now	Chinese Pharmacopoeia (2020)	cirsii japonici herba carbonisata, crinis carbonisatus, schizonepetae herba carbonisata, schizonepetae spica carbonisata, dryopteridis crassirhizomatis rhizoma carbonisatum to stop bleeding

Figure 1. *Examples of charred herbs.*

So far, a lot of historical recorded charred herbs are still widely used in clinic. A collection of clinical comparative studies of charred herbs from 2000 to 2021 in Table 2 indicates their wide clinic application and positive effect to stop bleeding. They are frequently used to treat purpura, metrorrhagia, upper gastrointestinal bleeding, postoperative hemorrhage of mixed hemorrhoids, and hemorrhoids bleeding. The applications to stop nasal bleeding, fundus bleeding, and bleeding after tooth extraction can be found, as well. All of them received significantly better therapeutic effects than the routine treatment of control groups. For an example, charring human hair to stop bleeding is the earliest description about charred herbs to our knowledge, which is still recorded in Chinese Pharmacopoeia (2020 edition) as crinis carbonisatus. In clinic, it is used to stop bleeding after tooth extraction individually nowadays, as well as treat purpura and metrorrhagia, combined with other charred herbs (Table 2). A novel nanofiber containing charred human hair has been under experimental investigation and proved effective in controlling severe bleeding [1].

Table 2. *Clinical Comparative Study.*

Disease	herbs charred in the prescription	effective cases	effective rate
Purpura	lonicerae japonicae flos, rubiae radix et rhizoma, sanguisorbae radix, rhei radix et rhizoma, cirsii herba, rehmanniae radix, typhae pollen, crinis carbonisatus, scutellariae radix, moutan cortex	57	95 [4]
	rehmanniae radix, cirsii japonici herba, cirsii herba, scutellariae radix, rubiae radix et rhizoma	39	97.5 [5]
	platycladi cacumen, schizonepetae herba, nelumbinis rhizomatis nodus, sanguisorbae radix	40	100 [6]
	schizonepetae herba, nelumbinis rhizomatis nodus, lonicerae japonicae flos	43	86 [7]
	schizonepetae herba, nelumbinis rhizomatis nodus, lonicerae japonicae flos	32	86 [8]
	schizonepetae herba, rehmanniae radix, gardeniae fructus	35	97.2 [9]
	schizonepetae herba, typhae pollen	22	95.7 [10]
	rehmanniae radix	128	93.4 [11]
Metrorrhagia	rehmanniae radix, gardeniae fructus, moutan cortex, phellodendri chinensis cortex, sanguisorbae radix, ramie root, cimicifugae rhizoma, typhae pollen, carthami flos, dryopteridis crassirhizomatis rhizoma	54	96.4 [12]

Disease	herbs charred in the prescription	effective cases	effective rate
Upper gastrointestinal bleeding	rehmanniae radix praeparata, rubiae radix et rhizoma, trachycarpi petiolus, sanguisorbae radix, crinis carbonisatus, mume fructus, nelumbinis rhizomatis nodus	98	98 [13]
	eucommiae cortex, sanguisorbae radix, nelumbinis rhizomatis nodus, cyperi rhizoma, crassirhizomatis rhizoma	52	92.9 [14]
	bletillae rhizoma, schizonepetae herba, trachycarpi petiolus, typhae pollen, sanguisorbae radix	125	100 [15]
	sanguisorbae radix, sophorae flos, crinis carbonisatus, typhae pollen, artemisiae argyi folium	57	95.0 [16]
	rubiae radix et rhizoma, sanguisorbae radix	53	94.6 [17]
	gardeniae fructus, sanguisorbae radix	50	100 [18]
	schizonepetae herba, typhae pollen	50	92.3 [19]
	typhae pollen	36	90 [20]
	gardeniae fructus, moutan cortex, platycladi cacumen, cirsii japonici herba, cirsii herba, imperatae rhizoma, notoginseng radix et rhizoma, rhei radix et rhizoma, bletillae rhizoma	40	97.6 [21]
	Ten ashes powder	99	99 [22]
	Ten ashes powder	29	96.7 [23]
	rhei radix et rhizoma	56	96.6 [24]
	rhei radix et rhizoma	50	96.2 [25]
	rhei radix et rhizoma	39	94.13 [26]
	rhei radix et rhizoma	43	96 [27]
	rhei radix et rhizoma	51	80.9 [28]
Postoperative hemorrhage of mixed hemorrhoids	Ten ashes powder	56	93.3 [29]
	Ten ashes powder	99	99 [30]
	Ten ashes powder	147	98.0 [31]
	Ten ashes powder	100	90.9 [32]
Hemorrhoids bleeding	rubiae radix et rhizoma, sanguisorbae radix, sophorae fructus, platycladi cacumen	153	91.1 [33]
	Ten ashes powder	160	100 [34]
nasal bleeding	gardeniae fructus	34	94.4 [35]
	rhei radix et rhizoma	34	94.4 [36]
fundus bleeding	platycladi cacumen	25	92.5 [37]
	gardeniae fructus	100	92.6 [38]
Bleeding after tooth extraction	crinis carbonisatus	75	98.7 [39]

In addition, a notable prescription named *Ten Ashes Powder* was first found in *Miraculous Book of Ten Prescriptions* in Yuan dynasty, which consists of ten herbs all charred to ashes (Table 1). It has become the most commonly used prescription in clinic from 2000 to 2021 (Table 2). Compared to the routine control treatment, it plays a more effective role in the treatment of upper gastrointestinal bleeding, postoperative hemorrhage of mixed hemorrhoids, and hemorrhoids bleeding.

According to Table 2, charred herbs have contributed a lot to the treatment of hemorrhagic diseases. For purpura, the most commonly used charred herbs are schizonepetae herba carbonisata and rehmanniae radix carbonisata. The prescriptions, suggested in the Chinese national *guidelines for TCM diagnosis and treatment of Henoch-Schonlein purpura*, also contain lots of charred herbs, for an example of crinis carbonisatus [2]. For metrorrhagia, both typhae pollen carbonisata and sanguisorbae radix carbonisata are used most frequently. Additionally, trachycarpi petioles carbonisata can be found in the suggested prescriptions in *International clinical practice guidelines of Chinese medicine metrorrhagia and metrostaxis* [3].

It is noteworthy that a new and original application form of charred herbs has occurred in the treatment of upper gastrointestinal bleeding. Different from the conventional oral decoction, the micron-sized rhei radix et rhizome carbonisatus was sprayed on the surface of the lesion through gastroscopy to stop upper gastrointestinal bleeding. It received very satisfactory results (Table 2).

At last, we suggest that the long-standing clinical applications from ancient times to the present prove the practicability, effectiveness and safety of charred herbs to stop bleeding.

3. Active Components with Haemostatic Effects

Traditional Chinese medicines charred to stop bleeding have contributed a lot to the health care of Chinese people for a long history. However, why the herbs need to be charred at first for haemostatic effects has been lack of adequate scientific explanation for a long time. A question needed to answer in advance is whether the haemostatic difference exists or not between charred herbs and uncharred ones.

According to the references from 2000 to 2021, many researchers revealed that the hemostatic effects increased significantly after the herbs charred, based on their pharmacodynamic animal experiments. Twenty evident examples can be found in Table 3. Therefore, it proved that significant haemostatic difference existed between charred herbs and uncharred ones. It emphasized a need to char the herbs before clinical use for sufficient haemostatic effects. The scientific reason intrigued a number of researchers. They sought for that through focusing on the change of active components.

Table 3. *Significant changes of components and hemostatic effects of animal experiments after herbs charred (+: increased; -: decreased).*

No.	herbs	Content change	Hemostatic effects of animal experiments
		Tannins	
1	gardeniae fructus [48, 49]	+	+
2	typhae pollen [50]	+	
3	imperatae rhizoma [51]	+	+
4	mali fructus [52]	+	+
5	ten ashes powder [53]	+	+
6	sanguisorbae radix [41, 54, 55]	+	+
7	rhei radix et rhizoma [56]	+	
8	moutan cortex [57, 58]	+	
9	copperleaf herb [59, 60]	-	+
10	platycladi cacumen [61]	-	
11	crataegi fructus [62, 63]	-	+
12	mume fructus [64]	-	+
13	scutellariae radix [65]	-	
		calcium ion	
14	crataegi fructus [62, 63]	+	+
15	ten ashes powder [53]	+	
		Activated carbon	
16	scutellariae radix [65]	+	
17	gardeniae fructus [66, 49]	+	
18	platycladi cacumen [67]	+	
19	moutan cortex [68]	+	
20	scutellariae radix [69]	+	+
21	sanguisorbae radix [55]	+	
22	imperatae rhizoma [51]	+	+
23	mali fructus [52]	+	+
		Flavonoid aglycone	
24	nelumbinis receptaculum [70]	+	
25	sophorae flos [71, 72]	+	+
26	platycladi cacumen [43, 61, 71, 73]	+	+
27	typhae pollen [71]	+	
28	nelumbinis folium [74]	+	+
		Anthraquinone aglycone	
29	rhei radix et rhizoma [56, 75]	+	+
30	rubiae radix et rhizoma [76, 77, 45]	+	+
		Novel Carbon Dots	
31	phellodendri chinensis cortex [78, 79]	+	
32	cirsii japonici herba [47, 80]	+	
33	cirsii herba [46]	+	
34	moutan cortex [81]	+	
35	nelumbinis folium [82]	+	
36	crinis carbonisatus [83]	+	
37	schizonepetae herba [84, 85]	+	
38	schizonepetae spica [86]	+	
39	dryopteridis crassirhizomatis rhizoma [87]	+	
40	junci medulla [88]	+	
41	pollen typhae [89]	+	
		Not detected	
42	lonicerae japonicae flos [90]		+
43	rehmanniae radix [91]		+
44	selaginellae herba [92]		+

3.1. Tannins

Tannins are polyphenolic compounds naturally found in plants. They are able to contract capillaries of wounds and transform exudative protein into macromolecule precipitation which can attach itself to mucous membrane to stop bleeding [40]. Therefore, Tannins are regarded as active components for the haemostatic effects of Chinese herbs. With this notion, researchers began investigations on the change of tannins between charred herbs and uncharred ones, such as gallic acid and ellagic acid (Figure 2) [41]. Most of them found that the contents of tannins increased obviously after herbs charred, such as herbs No. 1 to No. 8 in Table 3. It seemed that the increase of tannins should be an explanation for the need to char herbs for haemostatic effects. However, some research provided opposite results that the contents of tannins decreased significantly after herbs charred, such as herbs No. 9 to No. 13. Hence, the tannins are only responsible for the haemostatic effects of a part of charred herbs but not all.

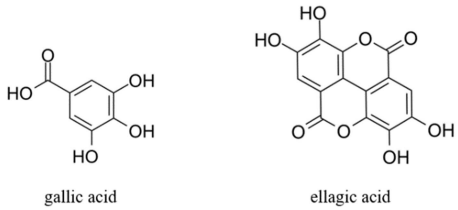

Figure 2. *Chemical structures.*

3.2. Calcium Ion

Calcium ion is a cofactor of blood coagulation and regarded as a main basis for haemostasis. It can promote protein coagulation in blood, activate numerous factors for polymerization of fibrin and blood coagulation, and reduce permeability of capillaries and cell membranes [40]. Two reports indicated that calcium ion of charred crataegi fructus increased significantly (Table 3). Additionally, the notable prescription named *Ten Ashes Powder* was also subjective to the research of calcium ion (Table 3). Researchers found calcium ion increased a lot and suggested the calcium ion played a part in the haemostatic effects of *Ten Ashes Powder*. On the basis of these, it is likely that the haemostatic effects of charred herbs depend on the increase of calcium ion. However, according to the report which researched the change of calcium ion on 20 different charred herbs, the likelihood is negative [42]. It turned out that the calcium ion increased only on 12 cases but decreased on 8 cases. In short, similar to tannins, it is difficult for calcium ion to explain the whole situations of charred herbs.

3.3. Flavonoids and Anthraquinones

Some research revealed definite haemostatic effects of some flavonoid aglycones and anthraquinone aglycones isolated from charred herbs, such as quercetin [43], pectolinarigenin [44] and 1,3-dihydroxyanthraquinone [45] (Figure 3). A number of studies found that flavone glycosides or anthraquinone glycosides decreased and their corresponding aglycones increased obviously after herbs charred (No. 24-30 in Table 3). Accordingly, they pointed out that the charring process caused this variation above, and the generated aglycones should have an effect on the haemostatic effects of charred herbs. Nevertheless, both the certain flavonoids and anthraquinones do not exist in all charred herbs. Thus, they may not able to become a widely applicable explanation for the haemostatic effects of charred herbs.

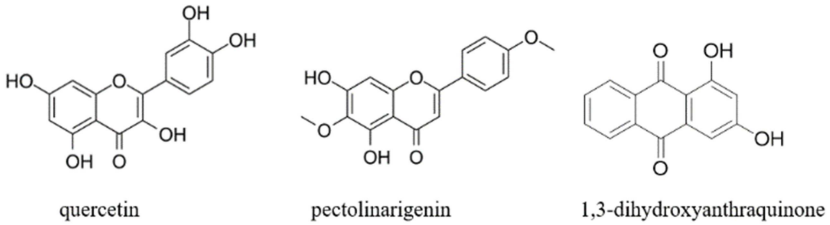

Figure 3. *Chemical structures.*

3.4. Activated Carbon and Novel Carbon Dots

Activated carbon with lots of loose holes is able to lead to physical adsorption to accelerate haemostasis. Meanwhile, it can activate plasma clotting factors, split blood platelet, and release blood platelet factors to promote coagulation [40]. Obviously, a certain amount of activated carbon will appear under the process of charring herbs by high temperature. It was proved in terms of many accordant experimental results that absorption capacity of carbon increased apparently in charred herbs (No. 16-23 in Table 3). In the light of this, the haemostatic effects of all charred herbs may be partly attributed to the emergence of activated carbon.

In recent 5 years, a novel substance has been discovered and may become another part of attribution for the haemostatic effects of all charred herbs. This novel substance, named carbon dot, is generated under charring process by high temperature similar to activated carbon. It has been described as a new class of carbon-based nanomaterials with quasispherical nanoparticles usually 1–10 nm in diameter. Compared to traditional semiconductor quantum dots, carbon dots are superior in terms of high aqueous solubility, easy functionalization, resistance to photo-bleaching, low toxicity, and excellent biocompatibility [46, 47]. This new discovery appealed to some scientists, typified by the research group of Prof. Qu Huihua from Beijing University of Traditional Chinese Medicine. Their latest research explored the haemostatic effect of novel carbon dots derived from various charred herbs and their related haemostatic mechanism. All results confirmed the definite haemostatic effect of carbon dots from different charred medicines (No. 31-41 in Table 3), for an example of charred human hair (Figure 4). Therefore, the novel carbon dots, along with activated carbon, play an important role in the haemostatic effects of charred herbs.

At last, let us go back to the original question why the herbs need to be charred at first for haemostatic effects in clinical use. We assume that the charring process to herbs would give rise to novel carbon dots and activated carbon with significant haemostatic effects, leading charred herbs to better haemostatic effects than uncharred ones. As for the diversity of haemostatic effects of different charred herbs, we believe their characteristic active components make the difference to some extent, such as tannins, flavonoids and anthraquinones.

Figure 4. *Haemostatic effect of carbon dots from charred human hair.*

4. Mechanisms

The haemostatic mechanisms of charred herbs have been subjected to exploration in depth mainly on their impacts on coagulation pathways, platelet systems and fibrinolytic systems. In the section two, we underlined the effective clinical application of charred human hair, ten ashes powder, and micron-sized rhei radix et rhizome carbonisatus. Let us take these as examples to discuss their haemostatic mechanisms (Table 4). According to these examples as following, we believe the charred herbs exert their hemostatic activity probably through activating coagulation pathway, strengthening platelet systems, and/or inhibiting fibrinolysis systems.

The results of mouse tail bleeding and liver hemorrhage experiments showed that novel carbon dots extracted from charred human hair had significant hemostatic activity. They were able to reduce APTT, increase plasma PIB and PLT in the whole blood, reduce plasma 6-keto-PGF1α concentration, increase TXB2 concentration, and degrade tPA, elevate PAI-1 and D2D level. These results indicated that the novel carbon dots as active components of charred human hair exerted the hemostatic activity by activating endogenous coagulation pathways and common pathways, increasing platelet counts, increasing their activation factor TXB2, lowering 6-keto-PGF1α, and inhibiting fibrinolysis systems.

It is reported that the aqueous extracts from *ten ashes powder* significantly decreased the bleeding time and coagulation time of mouse. They were able to decease PT, TT and PRT, as well as increase platelet aggregation rate. It is suggested that *ten ashes powder* played a hemostatic role through activating endogenous and extrinsic coagulation pathways, and strengthening the function of platelet.

Some research demonstrated the micron-sized rhei radix et rhizome carbonisatus were able to shorten the bleeding time of rabbit gastric tissue. It is indicated that they decreased PT and APTT, increased platelet aggregation rate, TXB2 and GMP-140, decreased 6-keto-PGF1α, and PGI2, but had no effect on t-PA and PAI-1. These results proved that the rhei radix et rhizome carbonisatus exerted their hemostatic activity by activating endogenous and extrinsic coagulation pathways, and strengthening the function of platelet, but had nothing to do with fibrinolytic system concerning t-PA and PAI-1.

Table 4. *Haemostatic mechanisms of three examples.*

Charred medicines	Methods	Results
Charred human hair [83]	(1) Evaluated the impacts on coagulation pathway through measurement of the coagulation parameters (PT, APTT, TT, and FIB) using mouse plasma (2) Evaluated the impacts on the platelet system by measuring platelet count, and the levels of TXB2 and 6-keto-PGF1α. (3) Evaluated the impacts on the fibrinolytic system by measuring the concentration of tPA, PAI-1, and D2D in plasma	(1) reduced APTT, increased plasma FIB (2) increased PLT concentration, reduced plasma 6-keto-PGF1α concentration, increased TXB2 concentration (3) degraded tPA, elevated PAI-1 and D2D level.
Ten ashes powder [93]	(1) Evaluated the impacts on coagulation pathway through measurement of PT, TT, PRT (2) Evaluated the impacts on the platelet system by measuring platelet aggregation rate	(1) Deceased PT, TT, PRT (2) Increased platelet aggregation rate
Rhei radix et rhizome carbonisatus [94, 95]	(1) Evaluated the impacts on coagulation pathway through measurement of PT and APTT (2) Evaluated the impacts on the fibrinolytic system by measuring tPA and PAI-1 (3) Evaluated the impacts on the platelet system by measuring platelet aggregation rate, TXB2, 6-keto-PGF1α, PGI2 and GMP-140	(1) Decreased PT and APTT (2) Had no effect on t-PA and PAI-1 (3) Increased platelet aggregation rate, TXB2 and GMP-140, decreased 6-keto-PGF1α, and PGI2

Note: prothrombin time (PT), activated partial thromboplastin time (APTT), thrombin time (TT), and fibrinogen level (FIB), platelet counts (PLT), thromboxane B2 (TXB2), 6-keto-prostaglandin F1α (6-keto-PGF1α), tissue plasminogen activator (tPA), plasminogen activator inhibitor-1 (PAI-1), D-dimer (D2D), plasma recalcification time (PRT), prostacyclin (PGI2), platelet granule membrane protein-140 (GMP-140).

5. Conclusions and Perspectives

More than 2000 years have witnessed charred herbs as contributors to the health care of Chinese people. Recent decades have also witnessed their novel developments in clinic, as well as witnessed wide scientific research on their active components and mechanisms of haemostatic effects.

Nowadays, they are mostly used to treat purpura, metrorrhagia, upper gastrointestinal bleeding, postoperative hemorrhage of mixed hemorrhoids, and hemorrhoids bleeding. It is noteworthy that a new and original application form of charred herbs has occurred. The micron-sized rhei radix et rhizome carbonisatus were sprayed on the surface of the lesion through gastroscopy to stop upper gastrointestinal bleeding. However, the conventional oral decoction is still a predominate application form, which has lots of disadvantages to use. Thus, there is an urgent need to develop more modern application forms to maximize effects and facilitate usages.

The continuing clinical applications of charred herbs since ancient times have proved the practicability, effectiveness and safety of charred herbs to stop bleeding. However, a consequent question arises why there is a need to char herbs in advance before use in clinic. A number of interested scientists actively sought for answers from the impacts of active components on the haemostatic effects. They found the content of active components increased significantly for a part of charred herbs, such as tannins, calcium ions, flavonoids and anthraquinones. In addition, the charring process to all herbs under high temperature would produce activated carbon and novel carbon dots, which proved to have obvious haemostatic effects. Accordingly, we deem that the emergence or increase of active components may lead charred herbs to significantly better haemostatic effects than uncharred ones, especially the emergence of activated carbon and novel carbon dots. This emphasizes a big need to char herbs at first before their clinical use. It leads to a new issue how to char herbs properly for maximum active components, which is related to the quality control of charred herbs. Hence, the optimum charring methods should be explored in depth for different herbs in the future. A universal, stable, controllable and widely applicable charring method is preferable. In addition, modern research indicates the haemostatic mechanisms of charred herbs are related to their ability to activate coagulation pathways, enhance platelet systems and/or inhibit fibrinolysis systems.

Acknowledgements

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References

[1] Zhu YY, Qiu Y, Liao LM (2015). Evaluation of hemostatic effects of carbonized hair-loaded poly(l-lactic) acid nanofabrics. J Nanosci Nanotechnol 6: 4193-9. https://doi.org/10.1166/jnn.2015.9799.

[2] Ding Y, Sun XX, Bi XL et al (1994) Guidelines for TCM diagnosis and treatment of Henoch Schonlein purpura. Journal of Pediatrics of traditional Chinese Medicine 6: 1-4. https://doi.org/10.3969/j.issn.1673-4297.2011.06.001.

[3] World Federation of Chinese Medicine Societies, China Association of Chinese Medicine (2021) International clinical practice guidelines of Chinese medicine metrorrhagia and metrostaxis. World Chinese Medicine 6: 870-877.

[4] Shen WL (2014) Treatment of bloody fever delirium with combined western medicine of decarb Decoction and 60 cases of hypersensitivity purpura. Chinese Journal of Traditional Medical Science and Technology 6: 718. https://doi.org/CNKI:SUN:TJYY.0.2014-06-082.

[5] Li YN, Wang J, Chen L et al (2019) Influing the curative effect of coagulation indicators and blood flow and study on the treatment of children allergic purpure with liangxue duocan decoction. Chinese Journal of Thrombosis and Hemostasis 4: 585-586+589. https://doi.org/CNKI:SUN:XSZX.0.2019-04-013.

[6] Yang SK (2010) Treatment of 40 cases of Henoch Schonlein purpura with Xiaodian formula. Chinese Journal of Trauma and Disability Medicine 2: 74-75 https://doi.org/10.3969/j.issn.1673-6567.2010.02.062.

[7] Yao HR (2015) Clinical effect of Carbonized catnip prescription combined with Tripterygium glycosides tablet in treatment of progressive pigmentary purpuric dermatosis. China Modern Medicine 26: 146-148 https://doi.org/CNKI:SUN:ZGUD.0.2015-26-050.

[8] Dan X, Zhai XX (2013) Jingjie tanfang combined with Tripterygium wilfordii polyglycoside tablets in the treatment of 37 cases of progressive pigmented purpura dermatosis. Fujian Journal of Traditional Chinese Medicine 5: 29-30. https://doi.org/10.13260/j.cnki.jfjtcm.011392.

[9] Gao SY (2000) Therapeutic effect of "three carbon syrup" and heparin calcium on 36 cases of purpura nephritis. Shandong Journal of traditional Chinese Medicine 12: 722-724. https://doi.org/10.3969/j.issn.0257-358X.2000.12.009.

[10] Qi SQ (2019) Treatment of allergic purpura with 23 cases using three char Decoction hegongpi decoction. Gansu traditional Chinese Medicine 1: 19 https://doi.org/10.3969/j.issn.1004-6852.2005.01.014.

[11] Kai JL, Liu H (2001) Journal of Ningxia Medical University. Gansu traditional Chinese Medicine 2: 20-21 https://doi.org/10.3969/j.issn.1004-6852.2004.02.012.

[12] Li YF (2014) Treatment of 56 cases of metrorrhagia and metrorrhagia with Shitan Decoction. Journal of Practical Traditional Chinese Medicine 10: 926-927 https://doi.org/10.3969/j.issn.1004-2814.2014.10.022.

[13] Han M (2011) 100 cases of dysfunctional uterine bleeding were treated with integrated traditional Chinese and Western medicine. Clinical research of traditional Chinese Medicine 13: 95 https://doi.org/CNKI:SUN:ZYLY.0.2011-13-062.

[14] Yan Y, Lei X, Ye LZ et al (2011) Clinical observation on 56 cases of adolescent dysfunctional uterine bleeding treated with traditional Chinese Medicine. Journal of Sichuan of Traditional Chinese Medicine 1: 100-101 https://doi.org/CNKI:SUN:SCZY.0.2011-01-052.

[15] Xing JX (2005) 125 cases of metrorrhagia and metrorrhagia treated with Ercao Wutan Decoction. Shaanxi Journal of Traditional Chinese Medicine 10: 1012-1013 https://doi.org/10.3969/j.issn.1000-7369.2005.10.016.

[16] Xia ML, Miao T, Xu WB et al (2018) Effect of Wutan decoction on 60 cases with per-menopausal dysfunctional uterine bleeding. Clinical medical research and Practice 27: 142-143 https://doi.org/10.19347/j.cnki.2096-1413.201827063.

[17] Cui HY (2011) The treatment of postoperative bleeding after induced abortion by Quyu hemostatic Decoction (56 cases). Journal of Practical Traditional Chinese Medicine 2: 89. https://doi.org/10.3969/j.issn.1004-2814.2011.02.010.

[18] Zhang GA (2013) Peony tonga reduced treatment of dysfunctional uterine bleeding 50 cases. Guangming Journal of Chinese Medicine 7: 1381-1382. https://doi.org/CNKI:SUN:GMZY.0.2013-07-053.

[19] Wang HY (2011) Treatment of 54 cases of climacteric metrorrhagia and leakage with sancan rengen Decoction. Hunan Journal of Traditional Chinese Medicine 2: 85-86. https://doi.org/CNKI:SUN:HNZO.0.2011-02-050.

[20] Lin YX (2014) Metrorrhagia and Metrostaxis; Clinical observation; Yin deficiency and blood heat; zhen qian particles. Beijing University of Chinese Medicine.

[21] Pang JY, Chen H (2016) Clinical observation of ten grey powder on the treatment of acute non varicose upper gastrointestinal bleeding. Journal of Liaoning University of Traditional Chinese Medicine 8: 205-207. https://doi.org/10.13194/j.issn.1673-842x.2016.08.064.

[22] Li C, Li YQ, Wang YF (2013) Clinical observation of pantoprazole combined with Shihui powder in the treatment of 100 cases of post-stroke stress gastrointestinal bleeding. Introduction to traditional Chinese Medicine 1: 49-50 https://doi.org/10.13862/j.cnki.cn43-1446/r.2013.01.066.

[23] Lin SW, (2011) Treatment of acute nonvariceal upper gastrointestinal bleeding with decagray powder. Guangzhou University of traditional Chinese Medicine. https://doi.org/CNKI:CDMD:2.1011.136094.

[24] Wang BM (2015) Effect of oral administration combined with gastroscope spraying micron rhubarb charcoal on gastric ulcer bleeding. Contemporary Medicine Forum 12: 186-187. https://doi.org/CNKI:SUN:QYWA.0.2015-12-160.

[25] Yu GP (2013) Spraying rhubarb charcoal particles under gastroscope in the treatment of 53 cases of upper gastrointestinal bleeding. China Pharmaceuticals 6: 102-103 https://doi.org/CNKI:SUN:YYGZ.0.2013-06-063.

[26] Song JK, Li HY, Li JM et al (2009) Clinical analysis of spraying rhubarb charcoal particles under gastroscope in the treatment of nonvariceal upper gastrointestinal bleeding. Chinese Journal of Misdiagnostics 19: 4615-4616. https://doi.org/CNKI:SUN:ZWZX.0.2009-19-071.

[27] Shi ZH, Zhang S, Hu w et al (2007) Clinical observation on spraying micron rhubarb charcoal through gastroscopy for hemorrhagic peptic ulcer. Journal of Internal Medicine 3: 134-135. https://doi.org/10.3969/j.issn.1007-1024.2007.03.009.

[28] He ZJ, Li RX (2014) Treatment of 63 cases of acute upper gastrointestinal bleeding with Zhixue powder combined with Western Medicine. Shaanxi traditional Chinese Medicine 09: 1119-1121 https://doi.org/10.3969/j.issn.1000-7369.2014.09.008.

[29] Ge XD, Li XH, Cui JJ et al (2020) Clinical study of Shihui powder in the treatment of postoperative bleeding of mixed hemorrhoids. Hebei Traditional Chinese Medicine 9: 1330-1332.

[30] Li CG, Sun ZH, Liu HY et al (2016) Prevention of primary anastomotic bleeding after PPH of circular mixed hemorrhoids with modified Shihui powder. Shanxi Traditional Chinese Medicine 1: 37-38 https://doi.org/10.3969/j.issn.1000-7156.2016.01.020.

[31] Liu HY, Li CG (2015) One hundred and fifty casses of anastomotic bleeding after pph prevented by flavored shihui powder. Henan University of Chinese Medicine 10: 2467-2468. https://doi.org/10.16367/j.issn.1003-5028.2015.10.1053.

[32] Li XJ, Wang D, Wang HS et al (2015) Clinical study of Shihui powder combined with external stripping and internal ligation and aggravated skin bridge construction in the treatment of circular mixed hemorrhoids. Journal of traditional Chinese Medicine 2: 199-201 https://doi.org/10.16368/j.issn.1674-8999.2015.02.067.

[33] Jiang DP, Luo Y, Zhang XL et al (2017) Self controlled trial of Qinji Liangxue mixture in the treatment of early hemorrhagic hemorrhoids. Journal of Changchun University of traditional Chinese Medicine 03: 448-450 https://doi.org/10.13463/j.cnki.cczyy.2017.03.034.

[34] Wang DS, Lu QG, Li XH (2016) Clinical observation of Shihui powder in the treatment of early internal hemorrhoids and hematochezia. Hebei Journal of Traditional Chinese Medicine 38: 95-97. https://doi.org/10.3969/j.issn.1002-2619.2016.01.029.

[35] Chen YQ (2014) Clinical observation on treating 36 cases of epistaxis with Zhizi Baiji Oujie decoction. Clinical Journal of Chinese Medicine 11: 111-112.

[36] Sheng FS (2012) Observation on 36 cases of epistaxis treated with rhubarb charcoal cuttlebone powder. Hainan Medical College 5: 94. https://doi.org/10.3969/j.issn.1003-6350.2012.05.042.

[37] Zhou XR, Wan MB, Li J (2012) Chinese medicine treated 27 cases of diabetic under-eye bleeding. Journal of Practical Traditional Chinese Medicine 9: 747. https://doi.org/10.3969/j.issn.1004-2814.2012.09.013.

[38] Zhang ZL, Zhou Y, Huang XF (2008) Study of the hemostatic components of seschlot charcoal. Chinese Traditional Patent Medicine 12: 1803-1805. https://doi.org/10.3969/j.issn.1001-1528.2007.12.029.

[39] Jiang ZG, Jiang QC (2001) Effect of residual blood charcoal on rapid hemostasis and prevention of dry socket in tooth extraction wound. Journal of Ningxia Medical University 08: 796-797 https://doi.org/10.16050/j.cnki.issn1674-6309.2011.08.007.

[40] Chen Z, Ye SY, Yang Y et al (2019) A review on charred traditional Chinese herbs: carbonization to yield a haemostatic effect. Pharmaceutical biology 1: 498-506. https://doi.org/10.1080/13880209.2019.1645700.

[41] Zhao H, Zhang XS, Dai YP et al (2018) The effect of the preparation on the content of the enamel components and the coagulation effect in the earth's crucifiium. Shandong Agricultural Sciences 12: 127-131. https://doi.org/10.14083/j.issn.1001-4942.2018.12.026.

[42] Gong YX, Lu XL (1991) Study on trace elements in the dissolution solution of 20 traditional Chinese medicines before and after charcoal frying. Chinese Journal of traditional Chinese Medicine 2: 85-87+126-127.

[43] Dan MQ (2013) Study on drying of Platycladi Cacumen and hemostatic mechanism after carbonized. Nanjing University of Chinese Medicine. https://doi.org/10.27253/d.cnki.gnjzu.2013.000003.

[44] Chen Q (2014) Investigation on the basis of hemostatic pharmacodynamic substances and the mechanism of hemostatic synergism of Chinese artichoke char. Beijing University of Chinese medicine.

[45] Zhang ZL, Lian B, Liu YM (2002) The chemical eye pill treated 108 cases of under-eye bleeding. Shandong Journal of Traditional Chinese Medicine 3: 149-150. https://doi.org/CNKI:SUN:SDZY.0.2002-03-012.

[46] Luo J, Zhang ML, Cheng JJ et al (2018) Hemostatic effect of novel carbon dots derived from cirsium setosum carbonisata. RSC adv 66: 37707-37714. https://doi.org/10.1039/C8RA06340K.

[47] Wang YZ, Kong H, Liu XM, et al (2018) Novel carbon dots derived from cirsii japonici herba carbonisata and their haemostatic effect. J Biomed Nanotechnol 9: 1635-1644. https://doi.org/10.1166/jbn.2018.2613.

[48] Pan LL, Liu J, Huang X, (2017) Dicussion on cooling blood for hemostasis and processing mechanism of carbonized gardeniae fructus. Chinese Journal of Experimental Prescriptions 23: 1-6. https://doi.org/10.13422/j.cnki.syfjx.2017230001.

[49] Yao L (2014) The study on the Material Basis of Gardenia Jasminoides fried into carbon. China Academy of Traditional Chinese Medicine.

[50] Ma HF (2005) Study on Chemical Constituents of Puhuang Charcoal. Beijing University of Chinese Medicine.

[51] He YY (2009) Study on hemostatic mechanism and quality standard of white grass root charcoal. Nanjing University of traditional Chinese Medicine https://doi.org/10.7666/d.y1646371.

[52] Yang HL, Huang DF, Nong HN et al (2018) Influence on chemical components contents and hemostasis of Malusdoumeri (Bois.) Chev under Stir-fry to Scorch preparation. Pharmacology and Clinics of Chinese Materia Medica 6: 129-133 https://doi.org/10.13412/j.cnki.zyyl.2018.06.031.

[53] Cui J (2004) Investigation on the material basis of hemostatic effect of 10 gray powder. Jiangsu Journal of Traditional Chinese Medicine 2: 46-48. https://doi.org/10.3969/j.issn.1672-397X.2004.02.027.

[54] Zhao H (2019) Preliminary study on the basis of carbon hemostatic substances based on grey correlation analysis. Shandong University of Traditional Chinese Medicine.

[55] Yu H, Mao BB, Liu HZ et al (2014) Effect of charcoal on the quality and hemorrhage effect of the molyes in *the earth*' cocoon. Chinese Traditional Patent Medicine 6: 1317-1320. https://doi.org/10.3969/j.issn.1001-1528.2014.06.048.

[56] Yang L, Wen Y, Liu Y et al (2020) Study on relationship between color characteristics of rhubarb charcoal in heating process and contents of 14 chemical components. China Journal of Chinese Materia Medica 17: 4230-4237 https://doi.org/10.19540/j.cnki.cjcmm.20200622.307.

[57] Li X, Wei XL, Zhao XL et al (2011) The changes of chemical components of peony bark before and after charcoal frying were compared. Chinese Journal of experimental prescriptions 23: 32-35. https://doi.org/10.13422/j.cnki.syfjx.2011.23.020.

[58] Zhao XL (2009) Research on the process and quality standards of danpi carbon concocting. Nanjing University of Chinese Medicine. https://doi.org/10.7666/d.y1646370.

[59] Wei XJ, Li XY, Zhao HB et al (2015) Influence of processing on the hemostation and the content of gallic acid in Acalypha australis. West China Journal of Pharmaceutical Sciences 4: 478-480 https://doi.org/10.13375/j.cnki.wcjps.2015.04.032.

[60] Li XY, Zhao HB, Sun XH et al (2015) Effects of different charcoal frying methods on hemostasis and gallic acid content of iron amaranth. Shizhen national medicine 3: 621-622 https://doi.org/CNKI:SUN:SZGY.0.2015-03-040.

[61] Yao XD (2009) Study on quality standard and hemostatic mechanism of Cacumen Platycladi Carbonisatum. Nanjing University of Chinese Medicine https://doi.org/10.7666/d.y1646352.

[62] Li SJ, Jia SJ, Yang L et al (2019) Changes of microstructure and coagulation components of Hawthorn before and after charcoal frying. Shizhen national medicine 6: 1352-1354.

[63] Xia MQ (2019) On the hemostatic material basis of hawthorn before and after charcoal processing with the theory"the red can be stopped by black medicines". Southwest Jiaotong University https://doi.org/10.27414/d.cnki.gxnju.2019.001663.

[64] Xu LY, Pan X, Xu K et al (2011) Study on the relationship between tannins, organic acids of mume-carbon and blood coagulation. Chinese Journal of Hospital Pharmacy 7: 535-537. https://doi.org/CNKI:SUN:ZGYZ.0.2011-07-006.

[65] Huang Q, Meng J, Wu DL et al (2013) Comparison of tannin content and carbon adsorption capacity of Scutellaria baicalensis before and after charcoal frying. Chinese Journal of experimental prescriptions 22: 82-84. https://doi.org/10.11653/syfj2013220082.

[66] Yao L, Meng J, Zhang C et al (2014) Content of the Tanning and Absorption Capacity of Carbon in Different Processed Gardenia Slices. Chinese Journal of Experimental Traditional Medical Formulae 4: 45-48 https://doi.org/10.11653/syfj2014040045.

[67] Chen C, Shan MQ, Ding AW (2009) Comparison of sorption of lateral cortex leaves and lateral cortex drinkers. Journal of Jiangsu Traditional Chinese Medicine 3: 57-78. https://doi.org/10.3969/j.issn.1672-397X.2009.03.036.

[68] Li X, Zhang H, Ding AW et al (2011) Comparative study on changes of adsorption capacity of peony bark before and after charcoal frying. Journal of traditional Chinese Medicine 08: 959-960
https://doi.org/10.16368/j.issn.1674-8999.2011.08.040.

[69] Zhao YS, Zhao JL, Liu CY et al (2020) Study on the correlation between *jaundice* charcoal hemostatic effect and adsorption. Yunnan Journal of Traditional Chinese Medicine and Materia Medica 7: 72-76.

[70] Wang CL, Zhang XL (2010) Determination of hyperoside and quercetin in different processed products of Nelumbins Receptaculum by HPLC. Chinese Patent Drug 10: 1729-1733. https://doi.org/CNKI:SUN:ZCYA.0.2010-10-026.

[71] Chen YQ (2016) Study on the correlation between transformation of flavonoids in Liangxue hemostatic medicine and its hemostatic activity. Nanjing University of Chinese Medicine.

[72] Zhao Y, Guo J, Liu T et al (2010) Pharmacological study of new hemostatic components after the production of charcoal. China Journal of Chinese Materia Medica 17: 2346-2349. https://doi.org/10.4268/cjcmm20101729.

[73] Shi DH, Dai YP, Su BZ et al (2020) Preliminary Study on the Scientific Connotation "carbonizing retains characteristics" of Platycladi Cacumen. Chinese Medicinal Herb 23: 5963-5971. https://doi.org/10.7501/j.issn.0253-2670.2020.23.008.

[74] Li K (2016) Study on quality control and hemostatic effect of lotus leaf and lotus leaf charcoal. Shanxi College of traditional Chinese Medicine https://doi.org/CNKI:CDMD:2.1016.316169.

[75] Guo DY, Wang M, Tang ZS et al (2010) Experimental study on changes of chemical components and hemostatic effect of rhubarb before and after charcoal frying. Shizhen national medicine 12: 3152-3153. https://doi.org/10.3969/j.issn.1008-0805.2010.12.053.

[76] Zhang ZL, Huang XF, Zhang CS et al (2008) Comparison of pharmacological effects before and after the fried charcoal of *madder* drink tablets. China Journal of Traditional Chinese Medicine and Pharmacy 10: 879-881. https://doi.org/CNKI:SUN:BXYY.0.2008-10-011.

[77] Zhang WH, Zhang ZL, Huang XF et al (2006) Comparison of hemostatic mechanism before and after the fried charcoal of madder drink tablets. China Journal of Traditional Chinese Medicine and Pharmacy 3: 160-162. https://doi.org/10.3969/j.issn.1673-1727.2006.03.008.

[78] Liu XM (2018) Study on Hemostatic Effect of Phellodendron chinense Charcoal and Its Mechanism. Beijing University of Chinese Medicine.

[79] Liu XM, Wang YZ, Yan X et al (2018) Novel phellodendri cortex (huang bo)-derived carbon dots and their hemostatic effect. Nanomedicine 4: 391-405. https://doi.org/10.2217/nnm-2017-0297.

[80] Wang YZ (2018) Study on hemostatic material basis and action mechanism of artichoke charcoal. Beijing University of traditional Chinese Medicine.

[81] Luo J, Hu J, Liu YH et al (2021) The effect Moutan coetex carbonisata nan-components on the blood-cooling and hemostatic. Acta Pharmaceutica Sinica 1: 15. https://doi.org/10.16438/j.0513-4870.2021-0676.

[82] Luo J, Zhao Y, Cheng JJ et al (2019) Nanoparticles derived from lotus Leaf Carbonisatus and their hemostatic effect. northwest pharmaceutical journal 4: 499-504.

[83] Cheng JJ (2019) Investigation on the material basis of "" hemostasis and treatment of epilepsy "" with blood carbon and its mechanism of action. Beijing University of Chinese medicine.
https://doi.org/10.26973/d.cnki.gbjzu.2019.000003.

[84] Zhang ML (2018) Study on the basis of *Jing mustard* hemostatic substance and its mechanism of action. Beijing University of Chinese Medicine.

[85] Zhang ML, Zhao Y, Cheng JJ et al (2018). Novel carbon dots derived from Schizonepetae Herba Carbonisata and investigation of their haemostatic efficacy. Artif Cells Nanomed Biotechnol 8: 1562-1571. https://doi.org/10.1080/21691401.2017.1379015.

[86] Sun ZW, Lu F, Cheng JJ (2018) Haemostatic bioactivity of novel schizonepetae spica carbonisata-derived carbon dots via platelet counts elevation. Artif Cells Nanomed Biotechnol 46 (sup3): S308-S317. https://doi.org/10.1080/21691401.2018.1492419.

[87] Xiong W, Zhao Y, Cheng JJ et al (2019) Novel carbon dots derived from Dryopteridis Crassirhizomatis Rhizoma Carbonisatum and their hemostatic effect. Chinese Traditional and Herbal Drugs 6: 1388-1394 https://doi.org/CNKI:SUN:ZCYO.0.2019-06-019.

[88] Cheng JJ, Zhang ML, Sun ZW et al (2019) Hemostatic and hepatoprotective bioactivity of junci medulla carbonisata-derived carbon dots. Nanomedicine 4: 431-446. https://doi.org/10.2217/nnm-2018-0285.

[89] Yan X, Zhao Y, Luo J et al (2017) Hemostatic bioactivity of novel pollen typhae carbonisata-derived carbon quantum dots. J Nanobiotechnology 1: 60. https://doi.org/10.1186/s12951-017-0296-z.

[90] Zhang DJ, Zhao X, Sun L et al (2020) Study on the change of cold blood hemostatic effect before and after *honeysuckle* fried charcoal. Lishizhen Medicine and Materia Medica Research 3: 603-605. https://doi.org/10.3969/j.issn.1008-0805.2020.03.028.

[91] Wang B (2020) Research on between "effects of hemostasis with epartly preservation"and carbonizing crafts of Rehmanniae Radix charcoal. Shanxi University of traditional Chinese Medicine. https://doi.org/10.27820/d.cnki.gszxy.2020.000099.

[92] Yang RF, Wu SH, Wei SH et al (2015) Effects of Selaginella Selaginella charcoal frying on bleeding time and coagulation time in mice. Traditional Chinese Medicinal Research 12: 70-73 https://doi.org/10.3969/j.issn.1001-6910.2015.12.32.

[93] Cui J (2004) Discussion on mechanism of hemorrhage and blood coagulation of shihui powder. Journal of Shandong University of Traditional Chinese Medicine 6: 463-466. https://doi.org/10.16294/j.cnki.1007-659x.2004.06.024.

[94] Zhang S (2007) Clinical and experimental studies of micron large *rheum* to treat peptic ulcer bleeding. Hubei University of Chinese Medicine. https://doi.org/10.3969/j.issn.1007-1024.2007.03.009.

[95] Wang RQ (2007) Clinical observation of micron rhubarb charcoal in the treatment of peptic ulcer bleeding and the mechanism of platelet system. Hubei University of Chinese Medicine.