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Article

Purification of Calcite, a Key Mineral in Traditional Oriental Medicine, Based on Malayan Berkh Descriptions: The Purification Process of Calcites

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Abstract: The growing burden of chronic stomach diseases has underscored the necessity of utilizing calcite-containing substances, which have been scientifically proven to safeguard the stomach lining. Calcite, a naturally occurring carbonate mineral, has been widely used in Oriental medicine for centuries due to its purported healing properties. Its applications have evolved through different purification and processing methods, reflecting historical advancements and regional pharmacological practices. This study investigates the diverse calcite processing methods documented in ancient sutras, particularly the "Difficulties' Commentary Malaya," and compares various sources to analyze the historical and contemporary significance of calcite in medicinal use. Through a meticulous content analysis, we identify eight distinct methods of processing and utilizing calcite in traditional medicine. Among these, modern Mongolian pharmaceutical industries predominantly adopt four primary processing techniques: hot, cold, rich, and smooth methods. These methods are applied to optimize calcite's therapeutic effects, ensuring its efficacy in treating digestive ailments. To maintain quality and standardization, the criteria for assessing calcite preparation undergo rigorous testing in both Chinese and Mongolian pharmaceutical industries. While Chinese pharmaceutical factories adhere to strict regulatory standards, Mongolian industries enhance traditional criteria by incorporating advanced analytical techniques, including modern physical technologies and sensitive device analysis. By bridging traditional knowledge with contemporary scientific advancements, this study aims to highlight the relevance of calcite processing in modern pharmaceutical applications and its continued significance in gastrointestinal health.

Keywords: Calcite Processing Method; Difficulties' Commentary Malaya; Traditional Medicine

1. Introduction

In the ancient Mongolian medical text "Medical Four Tantras" all internal diseases are caused by malfunction of the digestive system, which can be treated by calcite [1]. Furthermore, properly processed calcite can smooth cure incurable patients [2]. The term "Calcite" is a Tibetan word denoted as "Jonshi," "Jon" meaning signifies a

combination of chronic, "Shi" meaning heal [3]. To elaborate, calcite is recommended for the treatment of a broad spectrum of chronic digestive system diseases.

The year 2019 witnessed a significant global burden of digestive diseases, with an age-standardized incidence rate of 95,582 cases per 100,000 person-years (95% UI, 87,741–104,084 cases) across 204 countries and territories, translating to 7.3 billion incident cases (95% UI, 6.7–9.0 billion) [4]. Remarkably, the incidence of stomach cancer in 2020 ranked first in Mongolia and fifth in China [5], marking a new trend in this chronic stomach disease. Consequently, there is a crucial need to explore medicinal preparations, particularly those enriched with phosphorus, to diversify the range of ingredients containing this element. This exploration should be substantiated through clinical research.

Calcite, a naturally occurring mineral, has been the subject of increasing attention in the field of immunology due to its potential therapeutic applications. The ability of calcite to interact with immune cells and modulate their function has been a key area of research [6]. Calcite, traditional and oriental medicine has been used for centuries as a treatment for a wide range of medical conditions, including those related to the immune system. Recent scientific research has begun to shed light on the potential mechanisms by which calcite may exert its beneficial effects on the immune system. Studies have revealed that calcite can contribute to the differentiation of mesenchymal cells into osteoblastic cells. This suggests that calcite may play a role in the regulation of bone metabolism and the maintenance of a healthy skeletal system.

Osteoimmunology, a discipline examining the interplay between the immune system and bone homeostasis, has revealed that the immune system and associated factors may contribute to the pathogenesis of osteoporosis and play crucial regulatory roles [7].

Traditional Chinese, Japanese, and Korean medicine have long relied on natural substances such as herbs, minerals, and animal products to treat a variety of ailments [8]. In particular, the use of calcite, a calcium-based mineral, has been an important part of traditional healing practices in these regions. Calcite has been used in Traditional Chinese Medicine for centuries, often in combination with other herbs and minerals, to treat conditions such as liver disease, asthma, and other immune problems, as well as menstrual issues, colds, and headaches [9].

The "Difficulties' Commentary Malaya" intricately explores the "Medical Four Tantras", including calcite derived from the Malaya Mountain. Therefore, this research specifically focuses on the classification and identification methods outlined in this text, examining the scientific aspects of calcite and its purification process and drawing comparisons with other ancient sources, interpretations, and commentaries. This approach aims to shed light on the traditions, differences, and unique features associated with calcite, offering a comprehensive understanding of its role in Mongolian traditional medicine.

2. Materials and Methods

(1) Mi'I nyi ma Mthong ba Donidan, Difficulties' Commentary of the Malaya, Book 40, Beijing, 2006. Written in Tibetan in the 15th century.

(2) Mi'I nyi ma Mthong ba Donidan. Difficulties' Commentary of the Malaya. Handwritten sutra, in Tibetan script, size 23.5*5.5 cm.

(3) Mi'I nyi ma Mthong ba Donidan, Difficulties' Commentary of the Malaya, Handwritten sutra, written in Tibetan, size 29.5*10 cm.

(4) Yuthog Yondan Gonbu, Medical Four Tantra, Beijing, 2007. Mongolian text with Tibetan subtitles. Records from the mid-8th century serve as the primary source material.

In the 15–19th centuries, Tibetan doctors produced notable works, including Beidur Sngong po, Mes Po'i Shal Lung, Bka' 'Phreng Munsel Sgron me, Dka' gnad Rdo rje'i Mdud bkrol, Las kyi Cho ga Kun gsal Snang mdzod, Dri med Shel gong dang Dri med Shel preng dang Lag len Dces bsdus, Gser mchan Rnam bkra Gan mdzod, Tongwagajid, Jiduininnor, Meng Yao Zheng Dian, Ren Yao Xue, Many Important Things of Mongolian Medicine, A ru ra' Pgreng ba, Rtsa rgyud kyi 'Grel ba Gsal ba'i Srong me, Interpretation of the Hidden Meaning of the Root Tantra, compiled since the 1980s, along with resources like Study of Mongolian medicine purification process, Mongolian Medicine Records, Crystal Medicine Key, Meng Yao Jian Shi, Standard of Mongolian Medicinal Materials of Inner Mongolia and

Regulations on Purification Processed Mongolian Medicine of Inner Mongolia were used as reference materials for comparison.

2.1. Content Analysis

Content analysis is a broad term encompassing various strategic approaches employed to scrutinize texts. This method involves systematically coding and classifying words within extensive written material to discern trends, patterns, and the frequencies of their relationships and structures. Essentially, content analysis aims to determine the substance of a document by elucidating who expressed what and the impact it had on whom [10].

In our study, we applied content analysis to comprehensively analyze and condense the content of the "Difficulties' Commentary Malaya". This process primarily involved a comparative examination with other sources, allowing us to discern nuanced trends and patterns.

2.2. Comparative Method

Comparison stands out as one of the most prevalent cognitive methods, involving the examination of both the shared and distinct characteristics of real phenomena. Through the act of comparing two or more phenomena, a general understanding emerges, providing insight into the essence of the subjects under scrutiny. Comparisons are particularly valuable when exploring similarities between entities or aiming to uncover specific attributes (Figure 1) [11].

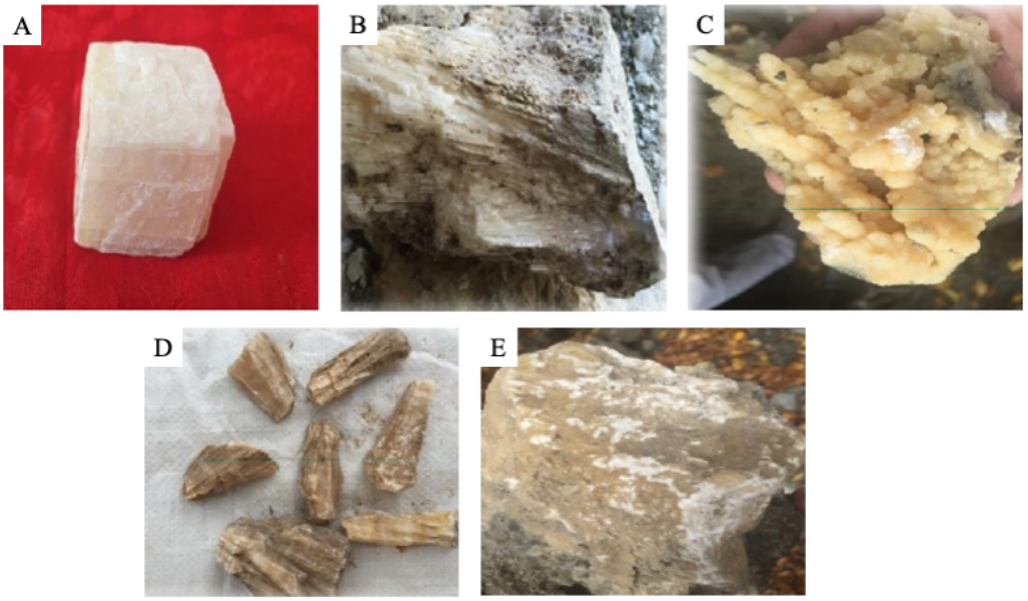

Figure 1. Comparative results on study explores the classification and identification methods of calcite based on traditional commentary source (**A**). calcite, $CaCO_3$, (male calcite); (**B**). rubrum Gypsum, Ca $(SO_4)\bullet 2H_2O$, (female calcite); (**C**). sypsum, Ca $(SO_4)\bullet 2H_2O$, (neutral calcite); (**D**). staglamite, $CaCO_3$, (son calcite); (**E**). sphene, $CaTi(SiO_4)O$, (girl calcite).

In the context of our study, we applied the method of comparison to delve into the identification, nomenclature, classification, and processing of calcite. This approach allowed us to discern patterns, draw connections, and highlight distinctions, contributing to a comprehensive understanding of the multifaceted aspects of calcite within our research.

2.3. Hermeneutic Method

"Hermeneutic" a Greek term signifying explanation or interpretation, served as our methodological approach. Through this method, we undertook the translation, interpretation, and comparison of original texts, professional literature and scriptures.

3. Results

The study presents comparative results exploring the classification and identification methods of calcite based on traditional commentary sources. It categorizes calcite into five distinct types: male calcite – calcite, female calcite – rubrum gypsum, neutral calcite – gypsum, son calcite – stalagmite, girl calcite – sphene. This classification provides insights into the traditional perspectives on calcite and related minerals, contributing to their systematic identification and study.

3.1. Results of Comparison of Calcite Classification and Identification Methods

In the "Difficulties' Commentary Malaya" the identification method for calcite is extensively detailed, encompassing 20 subcategories systematically organized into four distinctions such as male, female, son, girl and neutral each representing the five main calcite types: superior, noble, middle, and inferior. This meticulous classification results in the identification of 101 distinct calcites. In contrast, the other four comparative sources adopt a simpler five-degree classification for calcite.

Within the "Difficulties' Commentary Malaya" calcite is characterized as hard and heavy, drawing comparisons to squares and rock salts. However, alternative perspectives emerge in "Mes Po'i Shal Lung", "Beidur Sngong po", and "Interpretation of the Hidden Meaning of the Root Tantra" where male calcite is metaphorically associated with a broken horse tooth (Figure 2). Intriguingly, in the "Difficulties' Commentary Malaya" an emphasis is placed on treating calcite as superior male calcite.

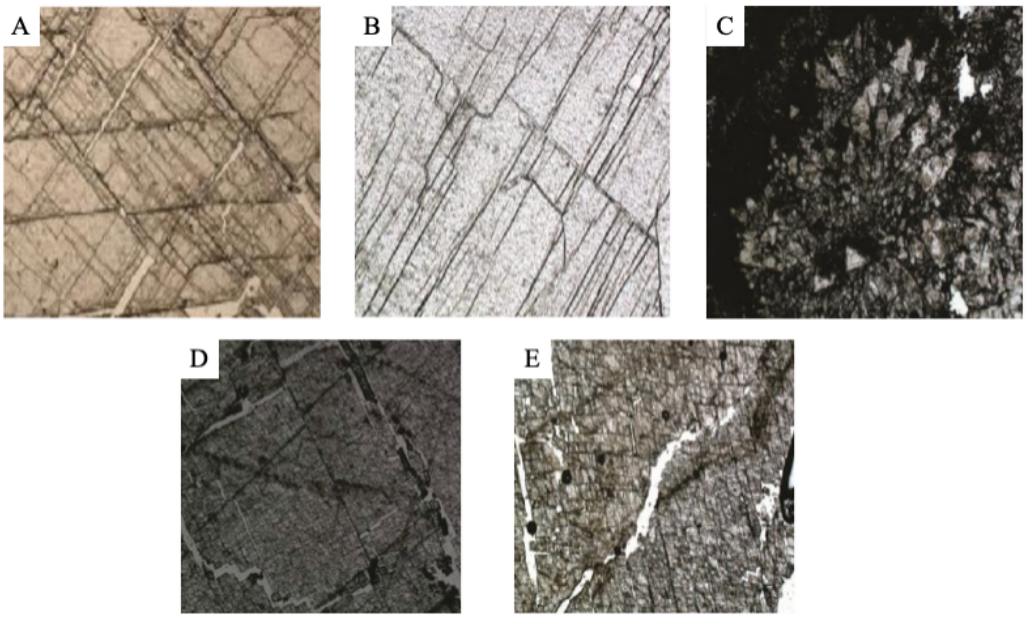

Figure 2. Microscopic appearance of calcite, compared with other minerals (**A**). calcite; (**B**). rubrum gypsum; (**C**). sypsum; (**D**). staglamite; (**E**). sphene.

This divergence in characterizing calcite underscores the depth and orderliness with which the "Difficulties' Commentary Malaya" approaches the identification methods of calcite. The nuances of these distinctions are succinctly summarized in Table 1.

3.2. Comparative Results of This Calcite Study Reveal Distinctions in Action

In the "Difficulties' Commentary Malaya" this classification of calcite types provides general and specific power of medicinal usage. The male, female and neutral calcites are best for curing Heyi, Xira, Badagan general diseases. Additionally, the son and girl calcite, clearly indicates its utility for addressing combined diseases.

Conversely, in "Mes Po'i Shal Lung", "Beidur Sngong po" the usage of calcite is succinctly summarized into five main categories, as outlined in Table 2.

Table 1. the divergence in characterizing calcite underscores the depth and orderliness with which the "Difficulties' Commentary Malaya" approaches the identification methods of calcite. The nuances of these distinctions are succinctly summarized.

Names of Commentaries	Type	Male Calcite	Female Calcite	Neutral Calcite	Son Calcite	Girl calcite
Difficulties' Commentary Malaya [12]	101	Hard, weighty, and possessing superiority, calcite is likened to a square, reminiscent of rock salt.	On the contrary, the lighter, fluffy, and superior female calcite shares similarities with mang ga bur.	Smoothly, gentle and superior neutral calcite is compared to a piece of conch, exhibiting a neutral nature akin to asbestos.	Slightly resembling male calcite, this type is akin to calcite itself.	The traits correspond to those of the upper girl calcite, resemble hindquarters of a white pig.
Rtsa rgyud kyi 'Grel ba Gsal ba'i Srong me (Danzanaltsan, 2019)	5	Hard and heavy.	Light and fluffy.	Smooth and gentle.	-	-
Beidur Sngong po [13]	5	Resembling a broken horse's tooth, calcite is characterized by its hardness, heaviness, and substantial nature.	Exhibiting a brown hue, reminiscent of a cow's udder, and calcite emerges between rocks.	Displaying white, red-yellow colors with a soft texture and long fibers.	The appearance features white coloration, long grain, and a pale, fluffy, and soft texture.	Calcite, characterized by its yellow color, is likened to lichen, exhibiting an appearance reminiscent of water algae.
Mes Po'i Shal Lung [14]	5	Hard, weighty, and resembling broked horse's tooth.	Exhibiting a brown hue akin to a cow's teat, indicative of gypsum.	Displaying a spectrum of white and orange, accompanied by elongated fibers, conveying a delicate texture.	White in color, resembling marble with distinct long grains. Exhibits a pale, fluffy, smooth, and soft appearance.	With a yellow hue and adorned by yellow lichen, it evokes a resemblance to yellow algae.
Interpretation of the Hidden Meaning of the Root Tantra (Altai, 1989)	5	Like horse teeth.	Gypsum brown.	The color is white, orange, and the grain is long.	The color is white and the grain is long.	The color is yellow, lichen like water yellow algae.

Table 2. "Mes Po'i Shal Lung", "Beidur Sngong po" the usage of calcite is succinctly summarized into five main categories.

Names	Male Calcite	Female Calcite	Neutral Calcite	Son Calcite	Girl calcite
Difficulties' Commentary Malaya	Cool, blunt and weighty, calcite is best for curing blood and bile disese	Exhibiting a contrasting nature, calcite is hot, sharp, and light, countering the cold effects induced by impure water.	Calcite is smooth and oily in nature. Calcite is best for treating hot and cold ailments. It works like a spring cure for hay fever.	Acknowledged for its commendable blend of high percentages of hot and cold disease, calcite is transforms into a source of relief during intense hot disease.	Calcite is best for curing a notable percentage of cold disease combined with phlegm and bile diseases. Best for curing combined with wind, bile and phlegm diseases.
Rtsa rgyud kyi Grel ba Gsal ba'I Srong me	-	-	-	-	-
Beidur Sngong po	Calcite is best for curing blood and bile combined with wind and phlegm disease	With utility extending to various conditions, calcite is deemed effective in a manner similar to a spring.	Calcite is like spring water, prolongs life and rejuvenates, and is considered a supreme medicine.	It is best for rejuvenation, and finds usefulness in the treatment Phlegm and cracked heads.	It is best for rejuvenation and best for curing kidney diseases, calcite exhibits versatility in its application.
Mes Po'I Shal lung	Calcite is curing blood and bile disease. It is good for curing diseases that are difficult to treat in young people	With a versatility that extends to all kinds of ailments, calcite is likened to a genuine spa in its comprehensive healing properties.	If used by both men and women, it is as effective as the spring.	It is best for rejuvenation and best for curing Phlegm, precancer disease combined with Wind, Bile and cracked heads.	Calcite's properties are likened to a spring, best for rejuvenation, and addressing issues related to kidney diseases.
Interpretation of hidden meaning of the root tantra	-	-	-	-	-

3.3. Comparative Results of Calcite Combustion Purification Processing

In Mongolian medicine, calcite is recommended to be extracted through the process of burning, utilizing the calcite as a raw material in medicine. This extraction is conducted in a total of eight distinct methods: fierce, conversion, hot, cold, rich, cool, warm, and smooth. However, caution is emphasized regarding the portion that remains unburned during the process. It is noted that "even if it is size of a sesame seed, it will be poisonous" [15] and if there is even a small amount of black color, it will be processed again, and as under-processed calcite may lead to stomach perforation. This underscores the importance of meticulous adherence to the established criteria for proper proof.

The purification processing of calcite is detailed in eight alternative methods. "Difficulties' Commentary Malaya," "Study of Mongolian Medicine Purification Process", "Crystal Medicine Key" written seven methods without conversion. Other texts like "Bka' 'Phreng Munsel Sgron me" written seven methods without rich. "Mongolian Medicine Records" written six methods without cold and rich. "Tongwagajid" written six methods without cold and rich. "Las kyi Cho ga Kun gsal Snang mdzod" written six methods without conversion and rich. "Meng Yao Jian Shi" written four methods conversion, warm, cool and rich. Meanwhile "Beidur Sngong po", "Dka' gnad Rdo rje'i Mdud bkrol" and "Jiduininnor" written fierce and conversion methods. "Meng Yao Zheng Dian" written Fierce, rich, cool methods. "Many Important Things of Mongolian Medicine" written warm and smooth methods of purification process approaches. Differing perspectives exist in the "Regulations on Purification Processed Mongolian Medicine of Inner Mongolia", "Standard of Mongolian Medicinal Materials of Inner Mongolia" and "Standard of Purification Processed Medicinal Materials of Mongem Pharm" written six methods without fierce and conversion. A summary of these

diverse approaches is presented in Table 3.

Table 3. Comparison between 6 characterisations of 16 commentary sources.

1. Difficulties' Commentary Malaya [2]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	-	+	+	+	+	+	+
2. Crystal Medicine Key [16]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	-	+	+	+	+	+	+
3. Study of **Mongolian Medicine P**urification **P**rocess [15]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	-	+	+	+	+	+	+
4. **Bka' 'Phreng Munsel Sgron me** [17]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	+	+	+	-	+	+	+
5. Mongolian Medicine Records [18]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	-	+	+	+	+	+	-
6. Tongwagajid [19]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	+	+	-	+	+	+	-
7. **Standard of Mongolian Medicinal Materials of Inner Mongolia** [20]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
-	-	+	+	+	+	+	+
8. **Regulations on Purification Processed Mongolian Medicine of Inner Mongolia** [21]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
-	-	+	+	+	+	+	+
9. **Standard of Purification Processed Medicinal Materials of Mongem Pharm** [22]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
-	-	+	+	+	+	+	+
10. **Las kyi Cho ga Kun gsal Snang mdzod** [23]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	-	+	+	-	+	+	+
11. Meng Yao Jian Shi [24]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	-	+	+	+	-	-	-
12. Beidur Sngong po [13]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	+	-	-	-	-	-	-
13. Meng Yao Zheng Dian [25]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	-	-	-	+	-	+	-
14. **Dka' gnad Rdo rje'i Mdud bkrol** [26]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	+	-	-	-	-	-	-
15. Jiduininnor [27]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
+	+	-	-	-	-	-	-
16. **Many Important Things of Mongolian Medicine** [28]							
Fierce	**Conversion**	**Hot**	**Cold**	**Rich**	**Warm**	**Cool**	**Smooth**
-	-	-	-	-	+	-	+

3.4. Comparative Results of Calcite Purification Process Technologies

The utilization of calcite in medical compositions and the corresponding methods of purification process in accordance with specific diseases are detailed in three synonymous ways within the examined explanations and works. However, the main source material, the "Difficulties' Commentary Malaya" stands out in highlighting the specific categorization of hot, cold, and Heyi during the purification process based on the disease indication. In contrast, the "Study of Purification process of Mongolian Medicine," "Crystal Medicine Key" and "Bka' 'Phreng Munsel Sgron me" in these books, the characteristics of the disease are briefly described in relation to hot and cold taxonomy.

In both the "Difficulties' Commentary Malaya" and "Bka' 'Phreng Munsel Sgron me" a distinct approach is taken to categorize the purification process with alcohol, mare milk and as entities under cold purification process. "Crystal Medicine Key" and "Study of Mongolian Medicine Purification Process" have been written together in the book fierce purification process. Notably, the "Difficulties' Commentary Malaya" introduces a unique aspect by recommending the use of water, milk, and alcohol for purification process with liquids. Additionally, unconventional elements like urine, sesame oil, and alcohol are suggested for the purification process, showcasing a distinctive approach. These variations are summarized in Table 4.

Table 4. Comparative results of calcite purification process technologies.

Names	Fierce Purification Process	Rich Purification Process	Cold Purification Process
Difficulties' Commentary Malaya	When using calcite in medicine, if you have a cold disease, use calcite that has been a fierce purification process. The initial step involves finely grinding calcite, followed by burning it on a coal fire until it reaches a broken state. To this, alcohol, brandy, and mare milk are added, and the mixture is stirred until it thickens.	When using calcite in medicine, if Heyi disease, a special rich purification process calcite should be used. The process begins by finely grinding calcite and then kneading it with a mixture of yak and sheep's milk, sesame oil, and alcohol. The resulting mixture is strained to extract the lymph. Subsequently, milk is added to the strained portion, and the kneading process is repeated.	When calcite is used in medicine, if it is a heat illness, especially a cool purification process calcite is used. The process involves finely grinding the substance and then combining it with rainwater, snow water, and eight-part water. After thorough drying, the substance is ground once again.
Study of **Mongolian Medicine P**urification **P**rocess	For a more controlled approach, a purified amount of male calcite is roughly measured and placed in a fireproof container. By burning it in a stove, the fierceness is processed. The subsequent steps vary based on the intended use: when dealing with cool ingredients, the calcite is placed in cold water; for hot ingredients, it goes into alcohol; and when dealing with smooth ingredients, mare milk is the chosen medium.	If you want a rich purification process, knead the calcite with milk.	Mentioned together with his ferocious purification process.
Crystal Medicine Key	A slightly modified process involves burning the purified male calcite on a stove until it turns red. Depending on the intended use, it is placed in cold water for cool characteristics, black alcohol for hot attributes, and mare milk for smooth attributes.	Mentioned together with cold purification process.	Cleaned calcite is finely ground into a powdery consistency, akin to fine bread. It is then either sprinkled with givan water or blended with cow's milk and left to dry in the shade. This processed calcite is utilized in medicinal compositions designed for addressing hot diseases.
Bka' 'Phreng Munsel Sgron me	A unique feature of this method is that, when burned on a coal fire and infused with alcohol or mare milk, a noticeable loud sound occurs. Tailoring the application to specific ailments, this purification process employs alcohol for cold disease and mare milk for smooth attributes.	-	When given for heat illness, put it in cold water.

3.5. Results Clarifying Calcite Purification Process in Modern Conventional Pharmaceuticals and Its Assessment of Completeness

Mongolian pharmaceutical factories in China primarily utilize male calcite (Calcite) containing carbonated calcium ($CaCO_3$) and female calcite (Rubrum Gypsum) containing hydrous sulfuric acid calcium ($CaSO_4 \cdot 2H_2O$) (Figure 3) [20]. The general purification process involves burning calcite at 600ºC, followed by a purification process with

hot or alcohol, cooling with cold or water, and absorption or with milk, and mare milk or smooth. The effectiveness of calcite mitigation is assessed through specialized tests conducted in adherence to the "Regulations on Purification Processed Mongolian Medicine of Inner Mongolia (Administration, 2020).

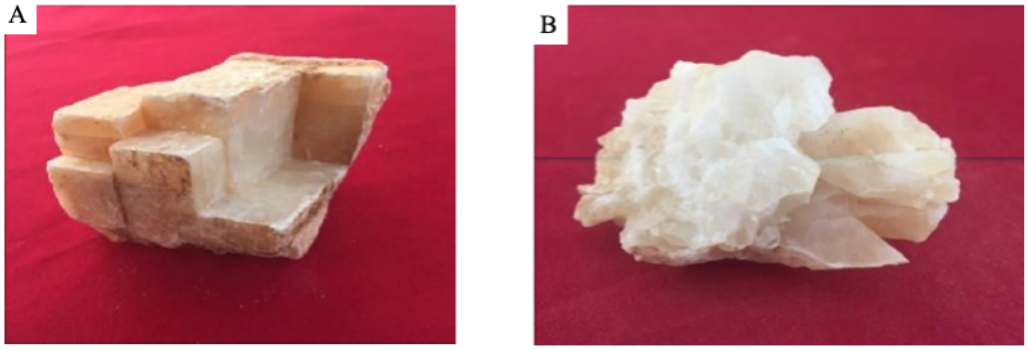

Figure 3. Male and female calcite used in Mongolian medicine pharmaceutical factories in China. (**A**). calcite (male calcite); (**B**). rubrum gypsum (female calcite).

Studies conducted on the burning action sequences and purification process criteria of male and female calcite in Mongolian medicinal plants in China [29–31] have shown their potential benefits for stomach protection and addressing chronic diseases. Additional research has been undertaken on stomach protection studies (Figure 4) [32, 33] and the conversion purification process technique [34].

In Mongolian pharmaceutical factories in Mongolia, root 5 calcite is purification processed using traditional burning methods, along with the use of alcohol, mare milk, and water.

Figure 4. (**A**). female calcite purification processed by burning at 600 ºC (Manba Datsan Pharmaceutical Factory); (**B**). female calcite purification processed by burning at 600 ºC (Manba Datsan Pharmaceutical Factory); (**C**). male calcite purification processed by burning at 600 ºC (Mongem Pharm Pharmaceutical Factory).

A noteworthy aspect is the extensive research conducted in Mongolia on calcite, with the results serving as criteria for the process. For instance:

In addition to the traditional criteria for calcite purification process, which include hot taste, sour smell, light color, pale yellow hue, a very powdery texture, noticeable fingerprints on grinding, tongue burning sensation, solubility in water, solubility when sprayed on goat lungs, and dissolution behavior in sheep stomachs, additional criteria have been established. These include sensitivity to a warm water bath of sheep intestines overnight, and the requirement that it should not be punctured (Figure 5) [35]. These meticulous criteria contribute to a comprehensive understanding of the calcite purification process.

The presence of purification processed calcite in alcohol and milk in goat lungs is depicted in both Figure 5A,B. Notably, incompletely purified processed calcite does not dissolve in the lungs of goats. Depending on the variety of purification processes, complete calcite exhibits dissolution in the lungs of goats at different times. This visual representation aids in understanding the effectiveness of calcite purification process methods.

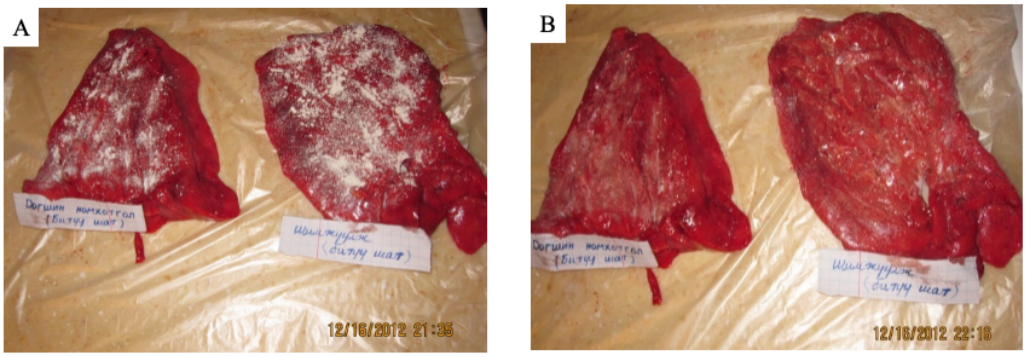

Figure 5. (**A**). the presence of purification processed calcite in alcohol and milk in goat lungs; (**B**). the presence of purification processed calcite in alcohol and milk in goat lungs.

These figures illustrate the outcomes of calcite purification process over a specific duration. In particular, Figures A and B portray completely purified processed calcite after a certain period, emphasizing the absence of intestinal perforation. In contrast, Figure C illustrates incompletely purified processed calcite after a specific duration, resulting in intestinal perforation and calcite leakage.

The establishment of these criteria is grounded in the research findings of the Institute of Veterinary Medicine (1994), highlighting that the intestinal temperature in sheep is approximately 37–39 degrees Celsius. To simulate this, an artificial water environment with the same temperature is created (Figure 6) [35]. This methodology ensures a controlled and accurate representation of calcite behavior in the digestive environment.

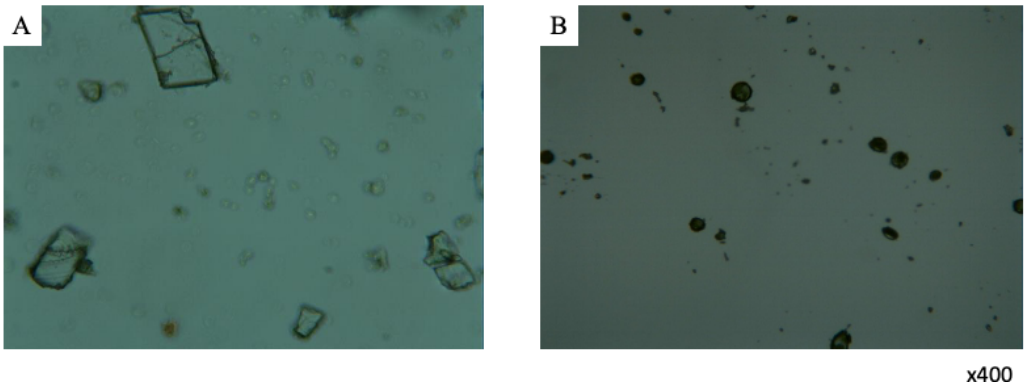

Figure 6. (**A**). microstructure of unprocessed calcite; (**B**). microstructure of fully purification processed calcite.

Figure 7 show that when calcite is heated to 500 °C, it contains the highest proportion of beneficial minerals. However, as the temperature continues to rise, the formation of calcium carbide (CaC_2), a harmful compound, increases, leading to a reduction in useful mineral content.

Furthermore, burning calcite at 500°C exhibits the highest percentage of beneficial mineral content. However, as the burning temperature increases, the harmful compound CaC_2 (calcium carbide) forms, and useful minerals diminish [36].

Modern techniques such as NANOPHOX (PCCS), GmbH, Sympatec, Germany 2011, were employed to evaluate the purification process of calcite to a nano-like size, assessing factors like average particle diameter, distribution width, specific surface area (Sv), surface average diameter (SMD), evaluated by volume mean diameter (VMD) [37].

Contemporary microbiological methods, radiation pollution research, and determination of specific activity of radioactive isotopes, following MNS 5626:2006 standards, are applied as additional criteria for toxicity and safety analysis [38]. Traditional indicators in Mongolia for calcite purification process have been supplemented by absorption in the lungs of goats and its effect on the intestines of sheep, coupled with analysis using modern physical technology and sensitive devices. This comprehensive approach ensures a valid assessment.

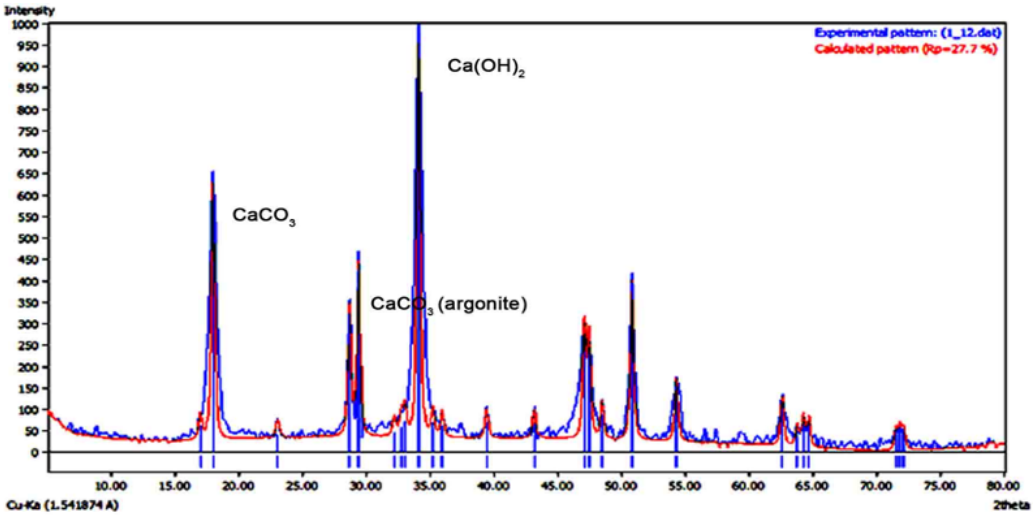

Figure 7. Diffraction spectrum of purification processed calcite, peaks were identified at 18, 29, and 34 degrees angles corresponding to the (650), (450), and (1000) planes, revealing the highest content of $Ca(OH)_2$ and the lowest content of $CaCO_3$ (Aragonite).

4. Discussion

The "Difficulties' Commentary Malaya" serving as the primary source for this research, meticulously classifies calcite into five main types, 20 subcategories, and a total of 101 calcites based on color. Notably, the identification method for calcite under 20 subcategories is more intricate compared to other similar applications.

In source descriptions, calcite is not only categorized by its root classification but also by color, including white, red, yellow, blue, and blue-red. The amalgamation of these colors results in 10 two-color mixtures, nine three-color mixtures, five four-color mixtures, and one five-color mixture, amounting to a total of 25 color variations. The suggestion that more classifications can be made based on color signifies that calcite has been recognized and employed in traditional medicine for an extensive period [39].

The "Difficulties' Commentary Malaya" divides the study of calcite into two categories: general and specific. The general action of calcite is best for curing Phlegm and precancer diseases, enhancing bodily strength, clarifying organs, and promoting overall well-being, especially in the elderly. Described as the pinnacle of wisdom, this study asserts that if utilized with the right nourishment, it can provide the power akin to a diamond, curing an impressive array of four hundred and four diseases without the need for additional medicines. A wise doctor has noted that calcite is used as a primary treatment [2]. The unique feature of this study lies in its individualized approach across 20 subcategories, setting it apart from other descriptive works in terms of detail and specificity.

In the "Difficulties' Commentary Malaya" and other comparative sources, calcite is identified to be purification processed through eight methods: ferocious, conversion, hot, cold, rich, cool, warm, and smooth. The methods for the fierce purification process of calcite involve burning it with charcoal fire, adding alcohol and mare milk when it turns white, with the result said to resemble bread silently [1, 13, 17, 19, 26, 27]. Other sources, such as "Las kyi Cho ga Kun gsal Snang mdzod" describe fierce purification process by placing them in a fire-resistant pot until reddened, then immediately transferring them to cold water [15, 18, 23, 29]. While other books refer to this process as a cold purification process, these sources categorize it as fierce purification process.

For hot purification process, instructions involve measuring calcite in bean-sized portions, frying it in an iron pot until brown, and covering it with black alcohol to prevent steam release. Cold purification process, on the other hand, suggests using two liquids simultaneously: grinding calcite into fine bread, rubbing it with water containing giwan, mixing it with cow's milk, and drying it in the shade [18].

In the context of purification process redness, the process includes grinding calcite to the thickness of a thumb, burning it until red in a fireproof container, and then soaking it in milk. The method of purification process involves using cold water, alcohol and mare milk combination [15, 16, 18].

The conversion purification process of calcite, often involving burning arura, tsha la, gyam tsha, pipiling, bongnga

karpo, calcite together, is detailed in various sources. Three types of calcite ash—small, medium, and large—are explained as a result of this process [1, 13, 17, 26, 27].

These sources, attributed to sages and scholars, consistently prescribe burning calcite for purification process and associate specific diseases with the hot, cold, or fierce nature of its medicinal use. Four kinds of liquids water, milk, alcohol, and mare milk are utilized in these purification processes, showcasing the versatility of calcite in recipes for various diseases, including leprosy, chuser, skin diseases, rheumatism, and infections [2].

A study comparing major works by Mongolian, Tibetan sages and explanations in sources revealed that calcite is included in 216 prescriptions of n eight types of drugs known for their action [40].

Concerning the boiling purification process of calcite, as described in the book "Bod kyi Gso rig Sman 'dul Chen po Lag len Bzhugs so" the process involves crushing calcite, rinsing it with water, adding herbal and mineral raw materials, boiling it in water multiple times, soaking it overnight, and then rinsing it again to eliminate any potential toxicity. This boiling purification process technique is notably distinct from traditional burning methods, highlighting the importance of further study and localization of this traditional medicine technology for calcite purification process [40].

In Mongolian pharmaceutical factories in China and traditional pharmaceutical factories in Mongolia, both male and female calcite are typically burnt at 600°C in a traditional manner. They are then subjected to various purification process methods such as heating or purification process with alcohol, cold or water purification process, digestion or purification process with milk, and flat or fermented purification process.

In Mongolian pharmaceutical factories in China, the criteria for calcite are rigorously examined using a special test, while in Mongolia, the traditional criteria indicating the complete purification process of calcite have been complemented by unique criteria derived from modern physical technology and sensitive device analysis, reflecting the influence of ethnic medicine.

5. Conclusions

(1) The "Difficulties' Commentary Malaya" serving as the primary source for this study, stands out from other comparative sources due to its more detailed explanation of the classification and identification of calcite.

(2) Within the "Difficulties' Commentary Malaya" the main source material for this research, specific methods for purification process calcite are prescribed. These include the use of water, milk, yeast, and alcohol, alongside unconventional elements such as urine, sesame oil, and alcohol. The integration of these diverse substances for calcite purification process aligns with the evolving landscape of pharmaceutical technologies, offering numerous benefits to the industry.

(3) Both Mongolian and Chinese pharmaceutical factories have identified two types of calcites and their traditional burning methods, encompassing hot, cold, rich and smooth. Notably, in Mongolia, the traditional criteria for calcite purification process have been enriched by incorporating analysis methods from modern physically sensitive apparatuses and sensitive nuclear energy measurement techniques. This blending of traditional wisdom with contemporary analytical approaches demonstrates a holistic and comprehensive approach to calcite purification process in Mongolian medicine.

Author Contributions

Conceptualization: S.B., B.B.; writing—original draft preparation, G.S., S.D., B.C. and G.B.; writing—review and data curation, M.R.; validation, B.B., S.B., S.S.;supervision. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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