

# Was Gunpowder Invented by Accident?

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**Abstract:** Yin-Yang theory is not only an ancient Chinese philosophical theory, but also the core part of the basic theory of Traditional Chinese Medicine, which runs through all aspects of the theoretical system of Traditional Chinese Medicine. Gunpowder is one of the Four Great Inventions of ancient China and a symbol of China's technological level at that time. It has a profound influence on the development of human civilization. Through the exploration of alchemy and gunpowder in early ancient China, it is found that Yin-Yang theory plays a very important role in the invention of gunpowder. Therefore, this paper discusses alchemy and Yin-Yang theory, the toxicity of Dan medicine and Yin-Yang theory, and the invention of gunpowder and the Yin-Yang theory.

**Keywords:** Yin-Yang theory, gunpowder, alchemy, cinnabar, toxicity

## 1. Introduction

Yin-Yang theory, a philosophical theory in ancient China, is the core of the basic theory of Traditional Chinese Medicine, having positive guiding significance to the diagnosis, treatment and prevention of disease. As *Miraculous Pivot* once mentioned, "Understanding how Yin and Yang work is like the confused one being disabused and the drunk one sober". Yin-Yang theory is rich in content, and its core is the correlation between Yin and Yang, which includes the mutual perception, mutual rooting, transformation, opposition, and waxing and waning of Yin and Yang. It has permeated all aspects of ancient people's life and practice, becoming an important guiding theory for the invention of gunpowder. Gunpowder, as the first of the Four Great Inventions of ancient China, leaves a profound influence on the development of human civilization. Therefore, the origin of gunpowder has become a significant subject for scholars in past dynasties. It is widely believed that the gunpowder was invented in the process of refining Dan medicine by accident, as Li Yuese, a famous British historian of science, once said, "It's not until some alchemists in Han Dynasty accidentally touched gunpowder and burnt themselves that they knew gunpowder could explode." Through the study of traditional Chinese medicine classics, I found that the invention of gunpowder was not an accident. Instead, it was invented under the guidance of some unique and systematic theories, among which Yin-Yang theory played an important role in the invention of gunpowder. And the following is a simple analysis of this view.

## 2. Alchemy and Yin-Yang Theory

It is generally believed that the invention of gunpowder is closely related to ancient Chinese alchemy<sup>[1]</sup>, which has a long history in China. According to historical records, alchemy dated back to the early Western Han Dynasty. People considered that some processed nature's substances (mostly minerals) could help them live a long life or even become immortal. The alchemist Wei Boyang once said, "Black sesame helps prolong life, let alone the Dan medicine which will never die. It is a treasure from nature." Alchemists tried to use Dan Medicine to invigorate Yang or nourish Yin to balance Yin and Yang in order to enjoy a long life or even live forever. *Huangdi Neijing* once stated that Yin and Yang is the principle of the circulation of heaven and earth, and the law of life and death of all things. Human life takes shape from the mutual perception of Yin and Yang, so if people want to be immortal, they should also comply with the principles of Yin and Yang.

In the early period, alchemy referred to refining cinnabar in the narrow sense. Through long-term practice, people noticed that the solid powder of cinnabar had good pharmacological effects on dispelling all diseases and benefiting Zang-Fu organs, spirit, Qi and eyes. After being melted for liquid, cinnabar becomes mercury, which is very toxic. Despite of this, it could be used to great effect elsewhere. It could be a killer on the one hand, and a healer on the other hand. Cinnabar was not only regarded as a top

traditional medicine in *Shennong Herbal Scripture*, but also has some special properties. In this book, the author pointed out that cinnabar could help relieve fright, tranquilize mind and benefit health cultivation, and it could turn into liquid mercury. Ge Hong, an alchemist in Eastern Jin also recorded that liquid mercury can be obtained by heating cinnabar, and it turns into cinnabar again when it crystallizes. To be more specific, the red cinnabar becomes silver-white liquid mercury when heated under seal, but when exposed to the air and heated, it will turn to solid cinnabar, and the cycle continues. People attributes such a wonderful change to the transformation of Yin and Yang: the solid one is Yang, and the liquid one is Yin, so Yang is transformed into Yin when solid turns into liquid, and vice versa. Yin and Yang is always transforming. In nature, the phenomenon of transformation between Yin and Yang is widespread, as what *The Book of Changes* stated—“As soon as the sun reaches the meridian it declines, and as soon as the moon is full it wanes.” Besides, after the Summer Solstice, the weather changes from hot to cool, while it gets warm again after the Winter Solstice, which is the most common phenomenon of the transformation between Yin and Yang. Amazed at the wonderful changes of cinnabar, people at that time believed that it differed from ordinary herbs, for it would never die. Hence, the Dan medicine made of cinnabar as the main raw material has been regarded as a rarity with an expected function of rejuvenation and immortality<sup>[2]</sup>, so cinnabar is also called “The Father of Dan medicine”.

### 3. Toxicity of Dan Medicine and Yin-Yang Theory

Taking Dan medicine was quite popular with the nobility in ancient China. Wang Xizhi, a calligrapher of the Eastern Jin Dynasty, was also keen on Dan medicine. A book of him recorded a meeting with his friend for exchanging ideas about Dan medicine--“The Dan medicine didn’t show its great flavor and effect, so I hope we can discuss about it tomorrow in the bazaar.” Zhang Junfang, a Taoist scholar of the Song Dynasty, also mentioned that “Qi and Dan medicine are the most important in health cultivation, but their benefits are ingenious beyond description.” These two examples reveal how enthusiastic people were about Dan medicine at that time. However, as time went by, the harms of taking Dan medicine also appeared gradually. Many people who took too much Dan medicine had symptoms of poisoning frequently, and many emperors also died from overtaking Dan medicine. It is recorded that after taking Dan medicine, an emperor of Five Dynasties had such symptoms--“Eyebrows and hair fall out quickly, with sores on the head and the back.” An emperor of Southern Tang Dynasty also died from sores after taking Dan medicine. Zhang Bangji described in his book that shortly after taking Dan medicine, one had blood in his stool persistently, became manic and finally his Zang-Fu organs collapsed and he died. Why did Dan medicine not play the role of strengthening the body and prolonging life, but showed its negative effects? According to *The History of Ming*, “The correct prescription of Dan medicine is hard to find and describe, and it’s not proper to take because of its dryness”, so in the long run, instead of making people living longer, it does great harm to people’s health. In fact, cinnabar is poisonless, but when it is heated, Dan medicine made of it has heat toxin and becomes very toxic, causing some Yang syndromes like vexation, irritability, thirst, sores on the head and the back, bleeding, etc. And some people even died from it.

From the perspective of Traditional Chinese Medicine, predominant Yang leads to heat, while predominant Yin leads to coldness. Overtaking Dan medicine of dryness-heat gets bad results. When there is inward invading of heat toxin, heat invading blood phase, blood failing to circulate in vessels and frenetic movement of blood due to heat, subsequently some syndromes like bleeding, vexation, irritability and thirst will appear; when Yang evil invades interstices, it may cause blood stasis due to Qi stagnation, meridian and collateral blocking, and abscess; when Yang evil invades liver, it may lead to liver depression and Qi stagnation, and consequently causes vexation and irritability. After repeated exploration, alchemists thought that these syndromes resulted from Dan medicine's impurity. In *Zhou Yi Can Tong Qi*, there is a record that people can discover the rules of mysterious change in the universe according to the movement of the sun and the moon—when the day is over the night is coming, and the moon will become full after it wanes. Zhang Jiebin also pointed out in *Lei jing* that Yin and Yang will go to the opposite when they come to the extreme. According to the property of transformation between Yin and Yang, in certain situations Yin or Yang will be transformed into its opposite<sup>[3]</sup>. And after continual refining, the Dan medicine could reach a dynamic balance and has lower toxicity. It becomes more refined after experiencing repeated trials of refining from cinnabar to mercury and then to cinnabar, and it is called “nine revolution Dan”. Why there is “nine” in the name? Firstly, in ancient China, “nine” here doesn’t mean “nine times”, but means “many times”. And most importantly, “nine revolution Dan” needs to be refined on the ninth day of the ninth lunar month--Chong Yang Festival. Because on this day, Qi of heaven and earth changes from Yang to Yin, and the fire refining accords with nature’s changes, and as a result, the toxicity of Yang heat in Dan medicine could be neutralized. In *Xun Zi*, it is recorded that

“When heaven and earth unite, all living things grow; when Yin and Yang meet, changes begin”, which means that the changes and growth of all things in nature are based on the premise of the mutual perception and interaction between Yang Qi of heaven and Yin Qi of earth. Secondly, “nine” implies longevity, which accords with people’s hope for a long life. Therefore, “nine revolution Dan” was refined after numerous trials, but it still failed to effectively lessen the side effects of Dan medicine.

According to Yin-Yang theory, when there is too much Yang heat, we should “treat heat syndrome with coldness-natured drugs” and reduce superfluous Yang, which means using something containing cold energy to offset Yang exuberance and clear excess heat. The dryness-heat of Dan medicine needs to be balanced with drugs with cold nature. In the *Shennong herbal Scripture*, there is a record that “Saltpeter, with cold nature, tastes bitter, mainly dealing with the accumulating heat evil of Zang-Fu organs”, and “When it is refined into paste, it could help to make the body healthier if people take it for a long time.” Therefore, saltpeter with cold nature was also used in the process of refining Dan medicine. At the very beginning, alchemists often used single herbs for the fire refining, and the main raw material was “eight stone materials” which included cinnabar, sulfur, saltpeter, etc. *Shennong herbal Scripture* recorded that “Sulfur, with warm nature, tastes sour”, and it was regarded as a curiosity, for it could melt gold, silver, copper and iron. It’s believed that the eye-catching gold is a symbol of wealth and supremacy, so Dan medicine was often golden in color, and it was called “Golden Dan”. And Zhang Yuchu, one of the most knowledgeable alchemists in the Ming Dynasty, once specially wrote a poem in praise of its brilliant color and endless changes. In the process of refining, people noticed that the mixture with sulfur could produce a mist-covered scene, which reminded people of immortals who could mount the clouds and ride the mist. So they mistook sulfur for an elixir, and often used it in refining Dan medicine. However, sulfur was active in nature and hard to control, so people gradually tried to refine the mixture of multiple herbs for Dan medicine. Thus sulfur, one of the basic ingredients of gunpowder, was introduced.

The earliest refining of sulfur and saltpeter can be seen in a book of alchemy in the late Han Dynasty-*Thirty-six Methods for Bringing Solids into Aqueous Solution*, which recorded the “aqueous method” for refining Dan medicine. Water is Yin, and fire is Yang<sup>[4]</sup>, so people tried to use aqueous method to lessen the heat of Dan medicine. Ancient Chinese people were adept in analyzing all kinds of drug properties with Yin-Yang theory. For example, in *Heavenly Creations*, Song Yingxing described that “Sulfur is pure Yang, while saltpeter is pure Yin, and when they meet, they react violently and make a tremendous noise, and gunpowder thus is invented.” By virtue of the ancient Chinese theory of transformation between Yin and Yang, Song Yingxing vividly described the changes of saltpeter and sulfur under certain conditions, but the effect was still not ideal.

#### 4. The Invention of Gunpowder and the Yin-Yang Theory

Saltpeter and sulfur are used in refining Dan medicine, but what does it have to do with the invention of gunpowder? Sun Simiao, an alchemist in the Tang Dynasty, recorded in *Qianjin Fang* that the main ingredients of gunpowder in early period were saltpeter, sulfur and charcoal. Nevertheless, saltpeter is pure Yang, while sulfur is pure Yin, so when they meet charcoal that functions as a source of ignition, they react violently, so “exploding tripod Ding” events often occurred in the process of refining. To find ways to prevent it, alchemists proposed that saltpeter and sulfur could be dealt with by using the method of “latent fire treatment”, and the earliest latent fire method for refining Dan medicine thereupon appeared. The word “latent” means to restrict or weaken something in a narrow sense, while in the broad sense, it contains many firing reactions in the process of refining Dan medicine. Lao Tzu once said that “The extreme of Yang is definitely Yin”, and *Huangdi Neijing* stated that “When Yang goes to the extreme, Yin comes, and vice versa.” Both of them show that Yin and Yang could be transformed into the opposite in the condition of reaching the extreme. For example, in nature, there is a phenomenon that “after the Summer Solstice, Yang Qi gradually weakens and Yin Qi grows.” The word “solstice” means the extreme point. In Summer Solstice, Yang Qi reaches the highest point, and things change when going to the extreme. After Summer Solstice, Yang Qi is getting weaker and Yin Qi is growing. And this is what is called “The extreme of Yang is definitely Yin”. The internal basis of the changes of Yin and Yang lies in mutual rooting of Yin and Yang. That is to say, they are interdependent on and fundamental to each other. In *Book to Safeguard Life Arranged by Categorized Patterns*, Zhu Gong stated that “Yin couldn’t grow without Yang, and Yang couldn’t change without Yin.” *Jingyue Quanshu* also recorded that “Those who are good at invigorating Yang usually add some medicines that nourish Yin.” The blast furnace is a small universe, so according to the mutual rooting theory of Yin and Yang, what in the blast furnace also conforms to such changes of Yin and Yang.

Under the pathological circumstances, the excess fire with hyperactive Yang heat will do harm to the

vital Qi of the body and make body weak. Similarly, in a short time with high fire, Yang in the blast furnace was transformed into Yin, making the Yang heat of Dan medicine tend to be mild and helping to reduce its toxicity. So people used charcoal as a fuel to make the fire grow stronger, and it can be seen in “burning sulfur method” recorded in *Qianjin Fang*. Alchemists tried to bury Dan medicine in the soil, and then made the fire stronger with charcoal. They kept the drug properties in the fire to neutralize the warm and dry nature of Dan medicine, making it conducive to the human body to take. This method coincides with the theory of traditional Chinese medicine processing, because traditional Chinese medicine often needs to be fried, calcined or simmered, and its properties are preserved and changed as well when it is heated, which could finally enhance efficacy and reduce toxicity of medicine.

To achieve a better result, alchemists went through long-term practice. After numerous trials of combination and compatibility, alchemists concluded that there would be an explosion when saltpeter, sulfur and charcoal were mixed in certain proportion, so these three became the main ingredients of gunpowder in the early period [5]. After many times of improvement, later generations mastered the technology of controlling explosions, and the earliest gunpowder in the world was invented.

To conclude, the invention of gunpowder was not an accident, but closely related to Yin-Yang theory, especially the transformation between Yin and Yang. It has experienced numerous trials from refining cinnabar and reducing its toxicity to explosion. During this long-term process, Yin-Yang theory runs through the invention of gunpowder as a guiding theory. Gunpowder, a symbol of ancient Chinese technological level, raising the national confidence and making a profound influence on promoting the development of world history. In addition, Yin-Yang theory is the crystallization of the labor wisdom of ancient Chinese people, and it is also the core part of the basic theory system of Traditional Chinese Medicine. Until now, it still plays an important role in people’s life and practice, having a guiding significance in the diagnosis and treatment of difficult miscellaneous diseases. There is no doubt that Yin-Yang theory is part of the great traditional Chinese culture, and we should both inherit and develop it, making it reach out to the world!

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