How did they Dye Red in the Renaissance?

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Dyers in the middle ages and Renaissance were quite proficient practical chemists. Red dyes at the time required the proper understanding and usage of four things: Mordants, Water, Dyestuffs and Modifiers.

Mordants Mordants are chemical substances applied to the fiber before dyeing. They help the dye to stick to the fabric ("mordant" comes from the word "bite"). Some mordants can also affect the resulting color of the fibre.	**Renaissance mordants used for red** *Rock Alum* (Potassium Alum). This is the primary mordant used for red dyes on wool or silk. *Tartar, or White Tartar* (Tartaric Acid). Tartaric acid crystals, created during the wine making process, were used in the mordanting bath to soften and protect the fabric against alum and to produce a brighter and more vivid red.
Water The pH and mineral content of water has a tremendous impact on the color of red produced. The notorious ph-sensitivity of renaissance red meant that professional dye works needed to be located next to water with the right pH balance. It's virtually impossible to dye red with hard water.	Dye houses were located ideally by running water, and tended to be set up in locations where the water was naturally amenable to dyeing red. Many people use distilled water when dyeing red, especially on silk (which tends towards pink rather than red if the water is at all on the alkaline end of the ph scale.) When dyeing material in bulk this isn't practical. Some people use calgon to help mitigate the effects of hard water. Fermented Bran Water is also useful for this purpose (Details in the "Modifiers" section below).
Dyes The dyestuff is what provides the pigment. For red dyes, the dye attaches to the mordant molecules which have attached themselves to the fibre molecules. Wool and Silk were dyed with all	**Red dyes used in the Renaissance** *Kermes:* a scale insect used to dye the most expensive reds throughout the middle ages. Its almost impossible to find now, and its modern new-world relative, *cochineal*, is used as a replacement when dyeing. *Cochineal* first came into use in the 16th century

of the substances to the right. There were very few recipes for dyeing linen red or pink, but those that did exist used madder and brazilwood.	when Spain brought it back from Mexico. It's red pigment is different (carminic acid rather than kermesic acid), but almost identical chemically and produces the same color. However cochineal has more dye pigment per gram of material than kermes did. *Madder:* The roots of *Rubia Tinctorum* were used to dye red since Roman times and most likely earlier. It creates a less brilliant and vivid red than kermes, tending towards brick red colors. It was sometimes used to boost or supplement kermes dye. *Brazilwood:* Caesalpinia Sappan originated in India. By the later middle ages it was used for creating pigments for painting (verzino) as well as for dyeing. Brazilwood creates an intense red, not so vivid as cochineal but more vivid than madder. Unfortunately it is more fugitive than either of the other two dyes and fades more quickly when exposed to sunlight.
Modifiers Modifiers were substances added to the dyebath, or to an afterbath, that affected the color of the dye.	**Alum (Potassium Aluminum Sulfate)** In addition to being a mordant, an afterbath of alum would turn a red cloth more towards the crimson/purple end of the spectrum. **White Tartar (Tartaric Acid)** In addition to being a mordant, an afterbath of tartaric acid can turn the fabric more towards the orange end of the spectrum. **Sal Nitre (Potassium Nitrite).** This is mentioned in a couple of recipes for scarlet in the Plictho. **Unslaked Lime (Calcium Oxide)** Calcium Oxide worked to make a dye bath or after bath quite alkaline. This was used in recipes for madder red to tweak the color away from a brick red and more to a blood red or crimson. **Ashes (Potassium carbonate)**

	When added to water, ashes created lye, an extremely alkaline substance. Like unslaked lime, it worked to turn orangish reds more purple. Ashes are most frequently mentioned in recipes for madder red. **Cream of Tartar** A particular type of ash, made from lees of wine rich in tartar and vine ashes, created an alkaline lye that was also rich in tartar. This helped brighten the color as well as buffering the fabric from the harsher lye. Other recipes specify combining this ash with unslaked lime in water which creates potassium bitartrate (aka cream of tartar). **Oak Galls/Tannic Acid** Although period recipes don't mention it, HPLC analysis of red dyes on medieval silk have revealed that tannic acid was used in the dye bath. When added to a dye bath, the tannic acid attracts the duller and more purplish pigments in kermes, allowing a purer red on silk (which tends to go pink/purple in kermes, otherwise) **Fermented Bran Water** This substance is mentioned in almost all recipes for madder. It turns the madder color more towards the red-purple end of the spectrum. My own experiments have revealed that it is also a "period Calgon", precipitating calcium impurities out of the water and binding to them. When added to a dyebath before the red dyestuff, fermented bran water will reduce the dulling effect of hard water.