Color Research on Porcelain Surfaces with Metal Salts

A. Feyza Cakir Ozgundogdu conducts research on the effects of soluble salts on porcelain

Image 1: ***Calmness.*** *2006. Modular composition, porcelain, coloured by cobalt chloride.*

The aesthetic effects that water soluble colorants have on white, colour diffusing porcelain materials offer a wide range of research topics for ceramic artists. Therefore this study summarizes my first steps in my attempt to follow the wide scale pointed out by Åse. It is believed that aesthetic pursuits using water soluble colorants and technology when combined with the creativity of inquisitive artists will create richer results.

WATER SOLUBLE COLORANTS ARE METAL SALTS such as sulphate, nitrate and chloride that can give colour on ceramic surfaces at about 1250ºC and above and that can dissolve in water. Due to their transparency, these colorants give many colour and dimension usage possibilities to artists working with semi-transparent porcelain. The extensive research of Arne Åse about these water soluble solutions are presented in the book titled *Watercolour on Porcelain*. The 'spring cleaning' with which Åse symbolizes a divergence from the stoneware tradition of the 1960s has moved him on to lighter, simpler materials. This famous book by Åse, is an example of intellectual and methodological questioning and application for artists researching the concept of research and related analyses in the field of ceramic art.

The research that you will read below is an exercise on a very short section of the process to which Åse hints in detail. A similar destiny of an "Aesthetic quest for a more refined colour and dimension possibility on ceramic products" and the methodological trial that was carried out following in the footsteps of Åse has led me to the process described below and resulted in the illustrated studies. This study will illustrate the usage possibilities of water soluble colorants that have characteristic colour and depth qualities in porcelain forms (Image 1).

The general characteristics of porcelain; its smooth texture, pure whiteness, semi-transparency and thinness, allow original forms of expression and production for ceramic artists. In ceramic products, semi-transparency is the quality of hardened bodies to transmit light to a certain extent. Due to this quality, glazed or unglazed thin porcelains

filter light to some extent. The absorption of light allows 'illusions' related to the volume of the body as well. Due to the closing pores on porcelain materials, light gives the surface a semi-opaque glittering texture. On this texture, light and shadow effects also gain a visible effect (Image 2).

An artist adopting such a style may avoid using glaze or a dominant colour. Because even if it is coloured or transparent, when a thin surface is glazed, the glaze becomes a different layer covering the original glassy texture. On the other hand, water soluble colorants are materials that offer aesthetic qualities which support the texture and semi-transparency qualities of the porcelain. Since these solutions are absorbed by the pores of the material, they create permeable colour values instead of a layered effect (Image 3).

The metal salts that are stated to be water soluble and which are treated in the scope of this research are colorant solutions of chloride, sulphate and nitrate. Also potassium dichromate and phosphoric acid solutions, which are not salts of metal and are not water soluble, create special aesthetic effects when used together with colorants. Due to the fact that water soluble colorants are not commonly used in comparison with the other oxide and carbonates used in the ceramic industry, there were some difficulties in procuring the raw materials for the study carried out in workshop conditions (Image 4).

The colorants that were used in the research are limited to solutions of iron chloride, cobalt chloride, copper sulphate and iron sulphate. Solutions of these colorants at different ratios and solutions of these colorants were applied to hard porcelain and bone china. At the same time potassium dichromate and phosphoric acid and their solutions were prepared and these were either applied directly or by mixing in to different solutions onto the surfaces coloured with different solutions.

Hard porcelain and bone china pieces were preheated at 1000ºC: the solutions were applied using a brush, sponge, effusion and immersion techniques. The surface absorption of the solution applied to the biscuit material was observed to be dependant upon the application method and the speed. Therefore, first results for the quantity of the solution to be applied may be misleading. That is why the ideal thickness that will be applied can only be decided by the artist based on his/her personal experience.

After a one layer application by the brush, the colour effect obtained by firing can be seen in the example. In applications where the solution was poured into the interior space of the cast, the solution was absorbed more. During the application, the liquid overflowed and this effect

Top left: Image 2: ***Spring.*** *2006. Coloured by iron chloride and coper chloride.*
Top right: Image 3: ***Landscape (Detail).*** *Porcelain coloured by iron chloride and phosphoric acid.*
Above centre: Image 4: ***View of Dry Metal Salts.***
Above: Image 5: ***Colour effect of brush application (iron chloride).***

was visible after firing (Image 5). This appearance is an interesting experience causing random marks to appear on the other surface. This technique forms textures based on the piece's hardness and thinness. Potassium dichromate has made it easier for the applied colorant to be seen from the other surface and also made the expected reflection to appear on either the interior or the exterior surface. When the solutions prepared by using these salts are applied to the surface, they colour the piece's profile and hence its other surface without creating extra thickness (Image 6).

After the porcelain is fired, the solution becomes semi-transparent. Depending on the combination of different salts, application method and thickness and also the desired visual effect, the salt density in the solution must be controlled by the artist. It is also possible to apply the solutions to the fired material (Image 7). However, for the solution to be able to hold on to the hardened surface, thickeners such as CMC or Arabic gum may be applied with control by brush. Therefore it is possible to create original colours and textures by applying such colorants on top of each other.

The firing of hard porcelain and bone china applications were performed at cone eight to 10 temperatures in an electrical kiln and in a reducing environment in a gas kiln. It was observed that the firing temperature and atmosphere is effective on the colour and texture of the parts on which the solutions are applied. It was observed that as the material hardens the colour quality is affected in a positive way, whereas there may be some deformations in the structure due to temperature and reduction. The choice of these variables is again up to the artist.

Two important safety related points that have to be kept in mind when working with metal salts are their toxic effects and the corrosion that they cause on equipment such as brushes, sponges and plastic cases. When working with solutions, direct contact should be avoided. No residue should be left in the environment and the environment should be ventilated properly during firing so that gases that are emitted are not inhaled.

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range of research topics for ceramic artists (Images 8, 9 and 10). Therefore this study summarizes my first steps in my attempt to follow the wide scale pointed out by Åse. It is believed that aesthetic pursuits using water soluble colorants and technology when combined with the creativity of inquisitive artists will create richer results.

Facing page top left: Image 6. ***Colour effect of infusion application (copper chloride).***
Facing page top right: Image 7. ***Application of solution on bone china surface.***
Facing page lower left: Image 8. ***Sisters.*** *2006. Porcelain coloured by iron chloride.*
Above left: Image 9. ***Greensward.*** *2007. Porcelain coloured by copper nitrate.*
Above right: Image 10. ***Porcelain pieces coloured by iron chloride, iron sulphate, cobalt chloride.***

Solutions prepared and used in the research

Colorants used in research	Grams per 100 ml/water
Iron Sulphate	100
Iron Sulphate	80
Copper Sulphate	30
Copper Sulphate	20
Iron Chloride	20
Iron Chloride	40
Cobalt Chloride	10
Potassium Dichromate	12
Iron Sulphate + Copper Sulphate	50+15
Iron Chloride + Copper Sulphate	15+15
Copper Sulphate + Cobalt Chloride	15+5
Iron Sulphate + Potassium Dichromate	50+6
Copper Sulphate + Potassium Dichromate	15+6
Cobalt Chloride + Potassium Dichromate	5+6

The extensive research of Arne Åse about these water soluble solutions are presented in the book titled Watercolour on Porcelain. The 'spring cleaning' with which Åse symbolizes a divergence from the stoneware tradition of the 1960s has moved him on to lighter, simpler materials. This famous book by Åse, is an example of intellectual and methodological questioning and application for artists researching the concept of research and related analyses in the field of ceramic art.

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