

Indigo and the Tightening Thread

For the Journal of Weavers, Spinners and Dyers 231 Autumn 2009

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Many varieties of indigo bearing plants flourish in hot and temperate climates all over the world and more than one can be found in any one region. The European indigo bearing plant is *Isatis Tinctoria*, known as woad.

Although there are an incredible number of species and subspecies, 'indican', the actual chemical source and precursor of indigo, a tiny organic molecule, is common to all. (A large percentage in the woad precursor is also indican, with Isatan B making up the rest) Consequently '....the resulting blue is indistinguishable even to the specialist' (Balfour-Paul)

Harvesting the plants, extracting the indican present within the leaves and storage of the indigo pigment differs from country to country. Though glycosides and enzymes vary, as does the alkalinity level and temperature of the water in which leaves are immersed, the following graphics illustrates, in essence, the acquisition of natural indigo through fermentation.

Fermentation Process



1. Indican, a glycoside molecule, is present within the leaf.
2. Bruised leaves release enzymes, which split up the glycoside by breaking off sugars thus freeing up indoxyl. A process known as 'Enzymatic hydrolysis'
3. Indoxyl is the unstable, soluble precursor to indigo. Dyeing can be done at this stage. This is how the traditional woad vat worked.

Oxidization



- With the introduction of oxygen (5) (whisking and beating the liquid) two indoxyl molecules (4), combine (6) to form the stable indigotin (7).
- This blue pigment is collected (en masse resembling blue mud) and is indigo. Dry, it is as hard as rock. It can be stored indefinitely. It is insoluble in water.



Natural indigo and synthetic indigo are both available to us. A key date in textile history is 1856 when 18 year old assistant chemist William Perkins, stumbled upon, developed and patented the first synthetic dyestuff from coal tar. 'Perkins Purple' became known as Mauvine. Later the German chemist Adolf von Baeyer synthesized indigo which was sold on the open market in 1897. Astonishingly, the molecular structure of natural and synthetic indigo, as it was then and as it is now, is the same.

Dyeing can only be done with indigo in its soluble form because only then can it attach to and be partially 'taken up' by the fiber. The pigment which we purchase, whether synthetic or natural is made soluble through reduction in vats. Adjusting the pH level of water to favor alkalinity and adding a reducing agent which removes or 'digests' some oxygen from the indigo causes it to change into leuco-indigo. A slightly different soluble form to that found during fermentation it is often referred to as 'indigo white' - utterly confusing as the liquid is, in fact, green to golden. Types of vat include the zinc and lime vat, the fermentation vat, the urine vat and the Hydrosulphite vat most commonly used world wide for both synthetic and natural indigo.

Indigo sits apart from other natural dyes requiring no mordant to 'fix' to both animal and vegetable fibers. And, though extremely light fast, it is susceptible to rough washing and rubbing as the tiny molecular structure provides little resistance to slippage. See *graphic*.

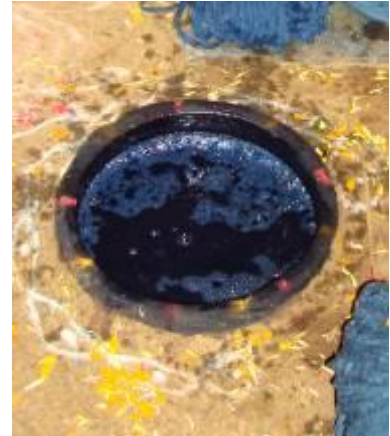


A silk fibre dyed with indigo showing sericin gum breaking away.



Left and below A large clay vat at the Institute of Rural Research, India, which stands in goats' dung to prevent fluctuations in temperature.

Note the prayer ring around the top of the vat below.



Whatever vat is made, the dyeing procedure is essentially the same. After the 'bloom' or scum is pushed to the side or removed altogether - in many cultures it is replaced after the dyeing tasks are completed - cloth is lowered into the vat carefully to avoid unnecessary oxygen uptake. When the cloth is removed, the indigo attached to the fibers oxidizes, that is to say the molecular structure changes having taken up oxygen, becoming blue pigment again and insoluble in water. This extraordinary event happens in front of our very eyes, and is mesmerizing. It fascinates now just as it must have done countless dyers of all nationalities from all over the world throughout the ages, establishing its mystery and magical status since antiquity.

Ingredients can be adjusted to keep the yield of indigo as we like. If the liquor appears cloudy the pH level needs balancing; too bluey then the oxygen content is too high requiring the addition of further reducing agent. Experience helps in the decision to 'sharpen' the vat, though even very poorly looking vats can yield up colour when the choice of fabric is suitable. The vat becomes 'exhausted' as the indigo content is diminished through use, but we can add more indigo too. Fermentation vats, a living entity of microbes, can be nurtured for years.

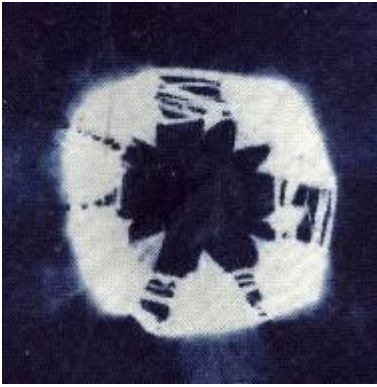
All vats are susceptible to fluctuations in temperature and measures taken to make sure that this is kept steady include setting them up off cold floors and out of drafts. Thomas Wardle of Leek, Staffordshire also kept the vat out of draughts, for as William Morris informs in a

letter written in 1876 to Aglaia Coronio 'The vat you must know is a formidable looking thing, 9' deep and about 6' square, and is sunk into the earth right up to the top!'

At the National Institute of Rural Development near Hyderabad I saw six large vats set in goat's dung. My own method has been to place a smaller container for the vat on a pile of newspapers or polystyrene blocks inside a larger container, then pack the void with crumpled newspapers, polystyrene chips or some such to form an insulation layer. Finally a layer of bubble wrap gets wrapped around the outside with old blankets and duvet over the top for good measure. Indoor vats don't require such pampering! One can use an aquatic thermometer also to keep the temperature steady. It is advisable to give all vats a gentle stir daily even when not in use. Vats can be any size and tiny vats are ideal to dye up a few threads.

Shibori dyeing.

Though a Japanese word, Shibori resist dyeing methods are to be found all over the world and are bound up within the history of indigo. It includes all the techniques that we perceive as 'tie dye', a term which, for many of us, brings to mind zany 'T' shirts of the 60's. However, Shibori is so much more, not only within the resist dyed outcome but also as three dimensional textile art.



The recognizable tie-dye motif is worked on different fabrics, in an array of colours and varying combinations around the world.

Shibori skills engage the practitioner intimately with fabric and have as much to do with their actions of wringing, pressing, squeezing the cloth, as the finished result. The actions physically work the cloth giving it form. Worked in many different ways with a degree of pressure and force they channel, influence flow, or prevent the dye from marking the cloth altogether. This third dimension encountered en route as it were, sets shibori apart from other textile coloring methods.

Probably the earliest and certainly a universal technique recognizable as the 'tie dye' motif, comes from binding thread round a plucked up section of fabric. It is found for example in Central and South America, The Middle East, Kashmir, Asia and reflects a delight in mark making and pattern by the artisans. In India we find fine *Bandhani* resists; Africa is renowned for the Yoruba stitched *Adire Alabere*, and tied *Adire Oniko* indigo cloths, and the Dida on the Ivory Coast manipulate raffia cloth to produce an array of tie-dye motifs.



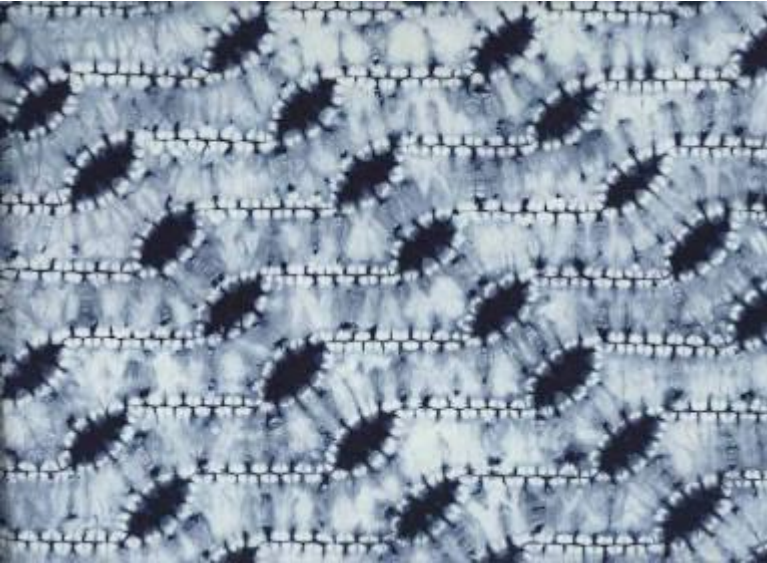
The minute areas of bound cloth, the resulting blue dots form an overall grid

There are the minute thread resisted rings of Japan, *ne maki shibori*, and dots when compacted together in various grid formations to infill larger shapes are known collectively as *kanoko shibori*.

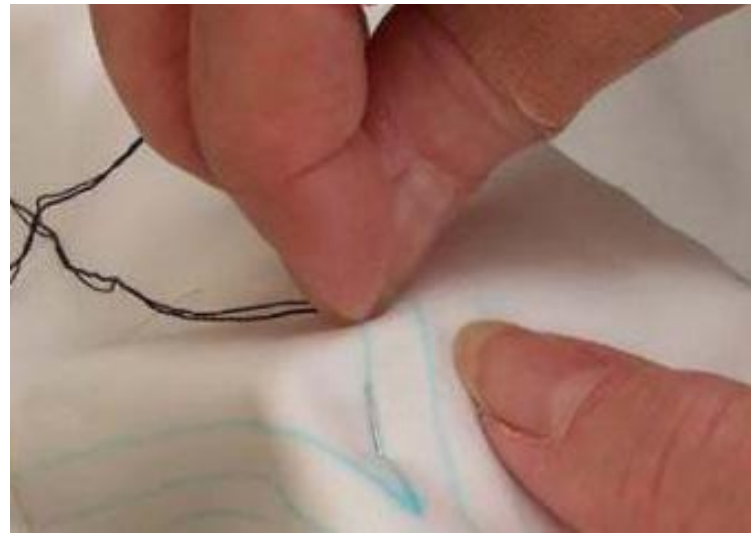


Examples of *Konoko shibori*. Densely packed dots cover a larger shaped area and are also used to form a linear pattern. They are also left out for negative patterning.

Bomaki describes techniques in which fabric is wrapped to a central support, such as a cylinder, and includes *arashi shibori*, a method which has become very popular. *Itajime* resists produce a much bolder dynamic of design as concertina folds in cloth are held securely in place with boards and clamps.



Study of a traditional stitch pattern but combined with a bomaki technique.

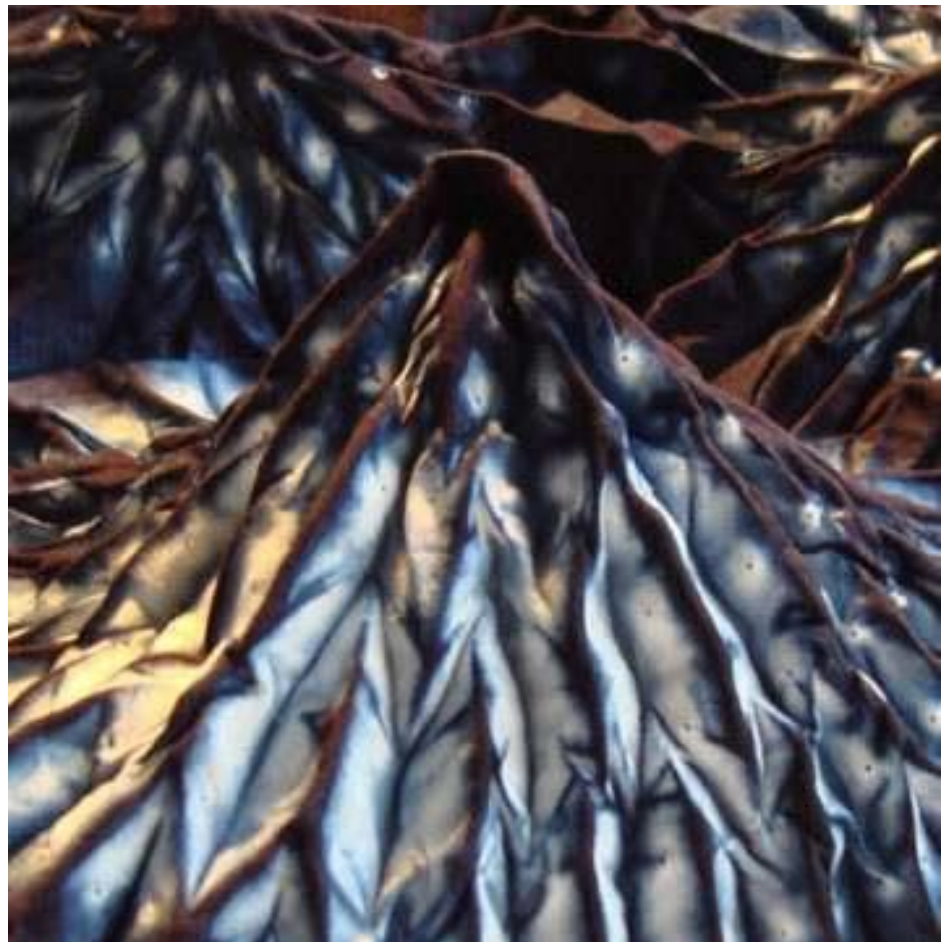


I use a strong thread doubled, for once the stitching is completed they are pulled up extremely tightly. These are then tied off to hold the fabric in folds and pleats throughout the dyeing procedures.

Karamatsu shibori with the stitches removed but as yet not washed out and still in its three dimensional form.

However it is with stitch resist that I have concentrated my focus and there are endless possibilities for motif and texture development and pattern making. I enjoy all the activities that this technique demands including designing. To ensure shapes work and flow for pattern they need to be drafted, considered, rejected and so forth, and this happens with pencil and paper, often a ruler, set square and compass as well!

Once the design has been resolved and transposed to the previously washed and ironed fabric stitching can begin. Straight lines of stitching produce the traditional *mokumi shibori* or wonderful wood grain texture whereas curved lines can result in *karamatsu shibori* or Japanese larch pattern. Results differ depending on weight of fabric; size of stitch, placement of rows one from another or the inclusion of a fold in the fabric.



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Soon the fabric piece will resemble a large sea urchin or similar, bearing no resemblance to a carefully planned design. After washing it needs to be well wetted out by soaking in warm water. If entered dry the dye liquor will be drawn in, a degree of resist will be lost and the result will be patchy. To minimize the introduction of oxygen to the vat the fabric can be soaked in water which has been de-oxygenated by the addition of reduction agent.

excess 'bloom'. Oxidization should be for as long as possible as this time is as important as actually dipping the fabric. It is always best for permanence of colour to allow the fabric to dry between dips but this is not always possible especially during workshops when time is limited. Check for blueness within the folds and if any golden green is still present then patience is required. Remember to replace the lid of the vat.



A light weight stitched shibori piece being reclaimed from the vat. Note the safety pin attaching a 'line' to the fabric.

The time to keep faith arrives when the bundle is relinquished to the golden depths. The options as to how this is done depend on what is being dyed. Large stitched pieces are usually too heavy with dye liquor when removed to have lines and sinkers attached which could tear the fabric so I prefer to lower these into the vat in long gloved hands. Smaller, lighter samples are fine. In both cases the fabric should be moved gently about well under the surface, which keeps the surface relatively undisturbed and allows the dye to flow around the shape. I find this to be a special, meditative time.

After anything from 30 seconds to ten minutes, depending on technique, fabric used and condition of the vat, the piece can be removed carefully and gradually to avoid drips which cause

Place large shibori pieces on a fine mesh of some kind and allow the indigo to drip through into a container. Newspaper isn't advisable as the fabric will simply sit in a puddle as it drains. Keep turning the piece over, brushing aside any of the 'bloom' which may have stuck to the fabric. Lighter silks can be hung up. Remember which way up they are and turn and or rotate them after each dip as this prevents repeated drainage at one end. Shibori pieces, if hung up, should be turned also. Sinker weights should be removed as these can cause visible drainage channels after the piece is washed and undone. It is a good idea to rinse off the fabric after two or three dips before continuing, and if a piece has dried it should be wetted out again.

Several dips are required to build depth of shade and evenness of dyed ground especially for highly patterned areas. I like to have the resisted areas shining out of a midnight blue and give up to 24 dips. Several dips are also recommended for permanence and if a dark indigo is not desired then making up or using a very pale vat allows several dips without building up deep tones. It is steeping the fabric repeatedly *in combination with* oxidization that results in resists unique to indigo. The dye uptake is concentrated on the peaks, the first area to oxidize resulting in punchy, defined marks, while the seepage of dye into the troughs yields delicate soft edged hues.



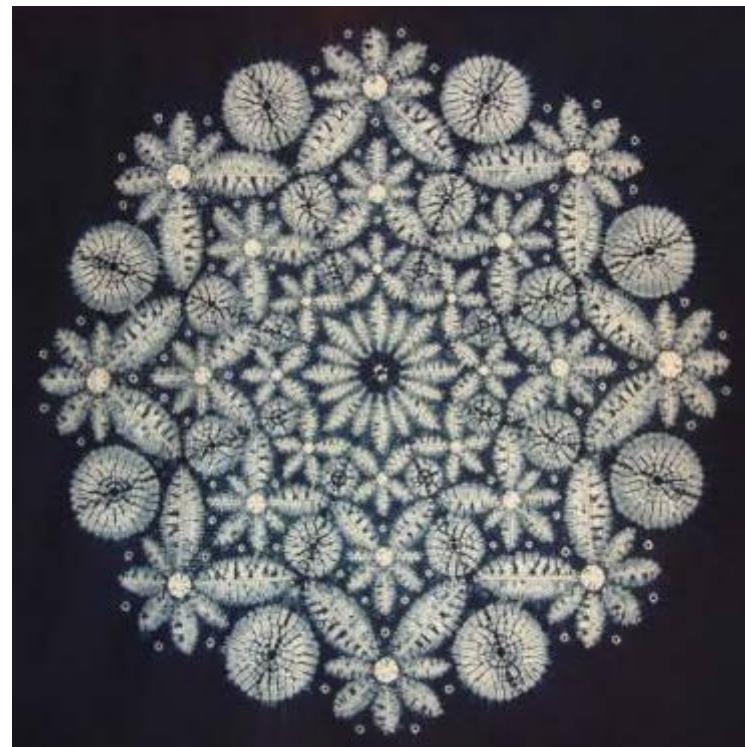
Above: *Stitch resist on a Chinese Miao skirt.*

Left: *Making a start on the exacting task of unpicking the tightly pulled up threads.*

Below: *'Kaleidoscope'*

Allow pieces to dry completely after the final dip. It is just as well to give a rinse before threads are cut and removed as this prevents excess indigo rubbing off onto resisted areas. Let it dry again before unpicking. Work steadily and slowly – it is not a task to be rushed! Finally rinse thoroughly with the cloth open and the water flowing through before washing gently in hot pure soapy water, remember that time and effort has gone into building up depth of shade.

Follow this with several rinses. Let it soak with some fabric conditioner and a splash of acetic acid or white vinegar to counteract the alkalinity before the final rinse. Squeeze out gently and hang it up to dry and then iron on the wrong side while still just damp. What is it about this blue that captivates us so?!



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Acknowledgements

Dr Paul Thomas, School of Biological Sciences, University of East Anglia for help with the imaging of a silk fiber dyed with indigo.