stern posts. The ship has iron frames, reverse frames, floors, box keelson, side and bilge keelsons, longitudinal and diagonal tie plates, sheer and bilge strakes main and 'tween' deck beams, deck stringers and mast partners. The iron frame is covered with a wooden skin, teak being used for the main deck and topside planking and American rock elm for the bottom planking, keel and false keel. The hull and keel are sheathed by Muntz metal (a copper-zinc alloy (Cu 59-63%, Fe 0.07%, Pb 0.3%, remaining % Zn)).

The *Cutty Sark* was moved to the dry dock in Greenwich in the 1950s where she forms a landmark structure. She is remarkable in that 80% of her hull fabric has survived from her original construction. However, in recent years structural surveys of the ship revealed the hull and ironwork to be in a state of severe deterioration. Typical damage to the ironwork, bolting materials and timbers is shown in Figures 8 and 9. Timbers adjacent to the iron frame exhibited signs of electrolytic decay resulting from a moist environment from the ingress of water (rain and sodium chloride contaminated wash down water) into the ship via leakage through the main deck. Chloride-induced corrosion of metalwork bolted to these timbers is evident, particularly in where the environment is humid and damp. In places, the degradation of the wrought iron is so severe that taking it apart to clean off the rust and thereby prevent further corrosion and loss of structural strength is not an option, particularly for the lower and more complicated regions of the ship. As the *s.v. Cutty Sark* is one of the three remaining vessels of this type of construction in the World, her preservation for UK and World Marine Heritage is vitally important.

Although electrolytic treatment of isolated artefacts of a singular construction is known, little data exits for such conservation procedures for intimately connected mixed materials. The objectives of the research programme carried out at the University of Portsmouth, in association with Hampshire County Council,[20] were therefore to determine (a) whether or not electrolysis of an iron/wood composite was possible, and, if so, (b) to determine the most suitable experimental parameters.

An initial survey of the ship was carried out to assess the levels of chloride contamination immediately above and below the false deck, in the bilges and areas adjacent to the Box Keelson, and in the Aft Peak area, and also to investigate the microbiological status of the timbers in these regions of the ship.

To profile the chloride ion concentration of the ship's timbers, core samples of wood were removed from timbers on the port side of the ship between the forward bulkhead and the aft cage section. Sampling was carried out at ten-frame intervals with three samples removed from each plank, one from the top of the frame immediately below the false deck, a second from a central location and the third from the lower region near the bottom of the bilges. A sample of wood was also removed from the underside of a timber from the main deck, for comparison purposes. The results of this survey confirmed the high levels of chloride ions in the lower regions of the ship with values as high as 90.0 mg chloride per g of timber in some locations.

A microbiological survey of the timbers of the ship was carried out simultaneously and samples tested for the presence of Sulphate Reducing Bacteria (SRB), Sulphur Oxidising Bacteria (SOB) and Iron Reducing Bacteria (IRB). The presence of a microbial infection comprising all three species in core samples from wet and dry timbers of the ship was identified.

Laboratory studies were then performed out to assess the suitability of electrolysis for the urgently required treatment of the structure of the *Cutty Sark* without causing further deterioration to its ironwork or attached wood. Preliminary work had identified possible problems associated with the use of electrolysis to remove chloride ions from wood/metal composite structures.[6] An experimental programme was devised to allow an understanding of the chemistry and microbiology of the electrolyte and thereby produce conditions