Structural characterization of Asian, Caucasian and African human hair keratinous fibres

Luis Gales Pinto, Instituto de Biologia Molecular e Celular, Porto, Portugal
Sérgio S. Funari HASYLAB Notkestrasse 85, D-22607 Hamburg, Germany

Ethnic hair is categorized into three major distinct groups: Asian, Caucasian and African. Despite different mechanical properties (African hair tends to be more elliptical in shape with the hair follicle showing a spiral shape; Asian hair has a round hair shaft with a very large diameter; Caucasian hair tends to appear structurally between that of Asian and African hair) the chemical composition is very similar (1, 2). The bulk of hair is of proteic nature with the structural lipids and other materials representing only a minor fraction. It was suggested but never deeply studied, or confirmed, that hair curling and the loss of tenacity of African hair might be related with cystine rich proteins (3) and their cystine, cysteine residues ratio (4). The amino acid compositions of the protein components is very similar between ethnic groups which is very interesting regarding biological variability, dietary habits, environmental effects and diversity of texture (2). The macromolecular structure of keratin derives its stability from a variety of intrachain and interchain interactions holding the protein chains together.

Chemical waving and straightening are two important hair-care treatments and, the objective of both is to impart to hair a durable configuration that is different from what hair exhibits in its native form. The underlying mechanism of waving and straightening is essentially molecular and involves manipulation of physical chemical interactions that stabilize the keratin structure. During stretching of keratin fibres a α - β transition occurs. Many studies have been done to explain how this transition occurs (5, 6, 7, 8, 9) and there are also many disagreements. However, one common thing between the existing theories is that the yield region has been interpreted as a result of the unfolding of the α – helical polypeptide chains, corresponding to the α - β transition. As demonstrated before, the α - β transition does not simultaneously occur while the keratin fibre is stretched but occurs during the subsequent setting process using steam (5).

In this work we performed X-ray diffraction experiments at Beamline A2 in virgin Asian, Caucasian and African hair samples, in order to observe if there are differences in the architecture of the filaments.

References