Genome sequencing of fungus with biotechnological applications

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Researchers Antonio G. Pisabarro (Professor of Microbiology) as well as José Luis Lavín and José Antonio Oguiza, from the Genetic and Microbiology Group at the Public University of Navarre, have taken part in the international project for the sequencing of the genome of the *Postia placenta* fungus. The results, published recently in the American National Academy of Sciences' scientific journal (*PNAS*), has enabled the determination of the mechanisms with which this fungus attacks wood in order to use the cellulose contained within. These results are important for designing processes using wood to produce bioethanol.

For the production of biofuel cereals, beet and other crops (first-generation fuels) have been used as raw material. Nevertheless, the controversies generated by this derived use of food products have made it necessary to look for new raw materials which are not foods and do not affect their price on the market In this sense, food and vegetable waste are a promising alternative (second-generation fuels). Access to the sugar that forms cellulose (the real starting point for the production of alcohol) is difficult in this type of waste. In this context, the results of the study of the *P. placenta* genome are one more step in the quest for more efficient and less contaminant processes for the production of alcohol from wood.

The project for sequencing and identification of the genes of this fungus, coordinated by Dan Cullen of the University of Wisconsin (USA), has taken two years to complete and 53 researchers from eight countries participated in it. If we were to transcribe in letters the almost

17,000 genes making up the *P. placenta* genome, we would occupy 7,000 pages with 33 million letters. As Gerardo Pisabarro, the person responsible for the team of researchers at the Public University of Navarre, explained: «the problem is not so much obtaining these seven thousand pages, because there are tools that enable us to do this; but it is reading them, deciphering what they are saying, identifying the genes and finding out how they work».

Fungi with white rot, fungi with brown rot

Trees are rich in cellulose and the sugar that forms part of the tree is mainly found in this polymer. However, unlike what happens with grapes - the sugar of which is easily useable with yeast to produce alcohol - obtaining glucose (and alcohol) from a tree is not so easy.

"There are two ways to degrade wood, pointed out Mr Pisabarro: there are timbers which, on rotting, go white - as a result of fungi; there are others which go brown, and this is produced by another type of fungus, such as P. placenta». The novelty with this fungus is how it intervenes in the degradation of the wood, its capacity to eat the cellulose without damaging lignin, the substance protecting the tree's cellulose. When we observe a tree, despite the fact that the cellulose making it up is mostly white, what we see is not white but brown. This is due to the layer of lignin protecting it and which gives it its woody appearance.

"This substance, lignin, protects the cellulose of the tree from attack by other organisms and the tree loses consistence, it rots and is broken down by other organisms; but it also makes it more difficult for us to obtain the sugar to produce alcohol. So, what we have to do is to break up the lignin layer. The fungi which eat (degrade or break up) the lignin leave the cellulose open to view and the tree rots with a coating of white rot. Fungi like *P. placenta*, nevertheless, are capable of eating the cellulose without damaging the lignin and, in fact, the trees affected by this

fungus, on rotting, end up with a brownish colour. Our goal is to find out the modus operandi of these fungi - how they manage to get the cellulose and, in this way, recover the greatest quantity of glucose from the wood in order to use it to produce alcohol."

Apart from the applied research, Professor Gerardo Pisabarro underlines the importance of basic research in genomics and in micro-organisms, given that "essentially all living things are organised in a similar manner. There are aspects of gene regulation that we can study in simples systems such as fungi, and obtain answers applicable to ourselves. We are also witnessing a veritable technological revolution in the sequencing of genomes that will probably enable us to know the sequence of individuals at an acceptable cost to health systems. This will mean a revolution in medicine, both diagnostically and as regards treatment of many illnesses in a more personalised manner."

Source: Elhuyar Fundazioa

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