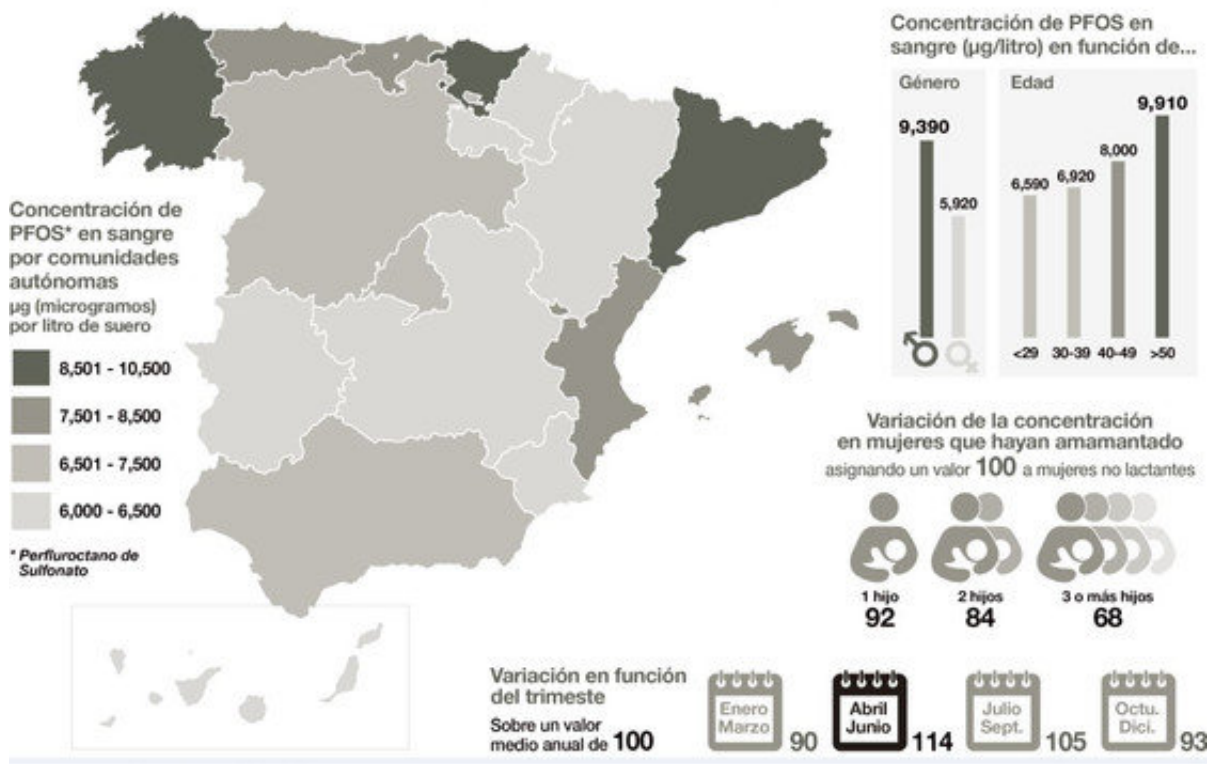


This is how perfluorinated substance pollution is distributed in Spain

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Contaminación por sustancias perfluoradas en España



Map of the distribution by autonomous communities of perfluorooctane sulfonate (PFOS) concentrations, one of the alkyl perfluorinated substances found in a multitude of products and industrial processes and that may pose a risk to health. Credit: José Antonio Peñas / SINC

Frying pans, pizza boxes, clothes and textiles are just some of the products which contain perfluoroalkyl compounds, used for their

chemical stability and resistance. Their exposure through air, house dust, drinking water and even food, makes them a serious risk for human health. Now, a group of scientists reveals the first exposure map of these substances among the Spanish population.

Due to their high stability and resistance to chemical, physical and microbial degradation, perfluoroalkyl substances (PFAS), a group of artificial chemical compounds, are used in a host of industrial processes and products.

Their chemical properties make them ideal components in the manufacture of water and oil repellent products, or products resistant to stains, such as non-stick kitchen utensils, clothes or even popcorn bags. However, they are also found in the food chain.

"Food, water and [house dust](#) are the main sources of exposure. However, to a lesser extent, we must also consider exposure through contact with consumer products which contain them, such as items of clothing and other textiles," SINC was made aware by Argelia Castaño, director of the Spanish National Environmental Health Centre (CNSA) of the Carlos III Health Institute.

Although there is still no evidence of the effects on people's health for all these compounds, two of them, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), are suspected of posing a risk to human health and even of being carcinogenic at certain concentrations. For this reason, in 2009, they were included in the list of restricted chemicals under Annex B of the Stockholm Convention, an international treaty which regulates the use of toxic substances.

According to the German Human Biomonitoring (HBM) Commission, the PFOS concentrations which are a health risk and therefore require intervention (HBM-II) have not been fixed, "although when values are

greater than 5 µg/l (HBM-I), we are reasonably certain that we cannot discard the possibility of adverse effects on health," Castaño remarked. In the case of PFOA, the limit (HBM-I) is established at 2 µg/l.

"Since 2000, important human biomonitoring studies have assessed exposure to PFAS, showing that global populations are exposed to them," the researcher pointed out. However, not all pollutants are regulated and many are still present in the environment.

Exposure of the Spanish population

To find out the extent in the Spanish population, Castaño and her team have created the first map detailing the exposure to these compounds. They used the data obtained through the Ministry of Agriculture, Food and Environment's bioambient.es project, launched in 2008 to understand the distribution of environmental pollutants such as metals, pesticides, flame retardants, perfluorinated substances and polychlorinated biphenyls in the Spanish adult working population and to establish reference values. The results have been published in the journal *Science of the Total Environment*.

The researchers analyzed the concentrations and geographical distribution of six PFAS in the serum of 755 Spanish adults aged 18 to 65—PFOS, PFOA, perfluorohexane sulfonate (PFHxS), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA) and N-methyl perfluorooctane sulfonamide (N-MeFOSA). The researchers confirmed that the Spanish population is exposed to these substances at similar rates as other European populations.

"PFOS, PFOA and PFNA were detected in nearly all 775 samples and PFHxS and PFDA in over 85 percent," said Mónica Bartolomé, the main author of the study and a scientist at CNSA.

"Residents in the northeast (Catalonia) and northwest (Galicia) of Spain had the highest PFAS serum values, while residents of the Canary Islands had the lowest values for nearly all PFAS," Bartolomé said. The levels of PFOS detected in the entire Spanish population exceed the HBM-I limits established by the German Human Biomonitoring Commission, indicating the importance of continuing to monitor levels of exposure among the population, the investigators stated.

Furthermore, age is an important factor to consider in exposure, due to PFAS being persistent and bioaccumulative. The study found that "the greater the age, the higher the levels." In terms of gender, men had higher levels than women.

However, when women who had breastfed one or more children were excluded from the study, post-menopausal women and elderly men presented similar PFAS concentrations. "This suggests that other channels of excretion, such as breastfeeding and menstruation, contribute to reducing the body burden of PFAS in women," the authors highlighted.

Scientists also believe that lifestyle impacts on PFAS levels. Exposure to tobacco and diet have a considerable effect. The study indicates that the consumption of fish is linked to various substances such as PFHxS, PFOA and PFOS. However, consuming beer and wine also increases concentrations: Regular beer drinkers (one to six beers per week) and wine drinkers showed an association with PFOA and PFOS. In the case of wine, PFNA and PFDA were also detected.

"We need to continue human monitoring studies, including other population sectors and broadening questionnaires, in order to identify additional sources of exposure; and then using this to optimise risk management measures," Castaño concluded.

PFAS, enemies of health and the environment

In September 2016, the Persistent Organic Pollutants Review Committee of the Stockholm Convention reached a consensus agreement confirming that perfluorooctanoic acid (PFOA) could cause significant adverse effects for [human health](#) and the environment.

PFOS and PFOA have been classified as potentially carcinogenic, according to the World Health Organisation, likely reprotoxic (toxic for reproduction) and harmful to vulnerable populations such as breastfeeding babies. "Although there is no evidence that other unregulated PFAS have a toxicity similar to PFOS and PFOA, the Strategic Approach to International Chemicals Management considers these compounds emerging pollutants," the researcher Argelia Castaño from the Carlos III Health Institute stated.

In recent years, different regulatory actions have modified levels of [exposure](#) to PFAS. "For example, voluntary restrictions of PFOA and PFOS resulted in declining levels of these compounds in human biological samples, while the presence of other unregulated PFAS, used to replace these two substances, has increased," she warned.

More information: Mónica Bartolomé et al. Perfluorinated alkyl substances in Spanish adults: Geographical distribution and determinants of exposure, *Science of The Total Environment* (2017). DOI: 10.1016/j.scitotenv.2017.06.031

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