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ORIGINAL

Architectures of finitude: New biomaterial practices from an ecofeminist perspective

Arquitecturas de la finitud: Nuevas prácticas biomateriales desde una perspectiva ecofeminista

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ABSTRACT

Ecofeminisms have emerged in the heat of social movements and form a diverse current of thought that explores synergies between feminisms and ecologies, from which it is affirmed that in order to sustain life, it is necessary to recognize the interdependence of life. The environmental crises have highlighted violence against women, in close relation to the violence suffered by nature, where gender and environment are intertwined under multiple, linked and comparable oppressions. In this sense, it is necessary to put in tension the non-neutrality of the constructive elements that surround us by analyzing their productive matrices within the capitalist system. Giving meaning to the field of materials engineering implies recognizing that technology is not neutral, in order to contemplate the ways of co-producing the habitat. It becomes urgent to know the environmental impact that material production generates on ecosystems. During the last decades, the development of bio-based materials has been growing. In this line, reflections are proposed about the environmental crisis articulated with gender inequality, and with experiences of new bio-based materials in the face of the need for access to habitat, as opposed to the hegemonic market logics that consider the city and housing -and therefore the materials that compose it- as a product and not a right. Thus, material developments are turning towards technologies where the sustainability of life is central, through the use of biodegradable materials, respecting the natural cycles of regeneration.

Keywords: bio-based materials, sustainable construction, gender, ecology.

RESUMEN

Los ecofeminismos, se han gestado al calor de movimientos sociales y conforman una corriente de pensamiento diversa que indaga sinergias entre feminismos y ecologismos, desde donde se afirma que para el sostenimiento de la vida, es necesario reconocer la interdependencia de la vida. Las crisis

ambientales, han puesto de relieve la violencia hacia las mujeres, en estrecha relación a la violencia sufrida por la naturaleza, en donde género y ambiente se entrecruzan bajo opresiones múltiples, vinculadas y equiparables. En este sentido, es necesario poner en tensión la no-neutralidad de los elementos constructivos que nos rodean analizando sus matrices productivas dentro del sistema capitalista. Dotar de sentido el campo de la ingeniería de materiales, implica reconocer que ninguna tecnología es neutra, para contemplar los modos de co-producir el hábitat. Se vuelve urgente conocer el impacto ambiental que la producción material genera sobre los ecosistemas. Durante las últimas décadas el desarrollo de materiales biobasados está creciendo. En esta línea, se proponen reflexiones acerca de la crisis ambiental articulada con la desigualdad de género, y con experiencias de nuevos materiales de base biológica frente a la necesidad de acceso al hábitat, en contraposición a las lógicas hegemónicas de mercado que consideran la ciudad y la vivienda -y por ende los materiales que la componen- como un bien y no un derecho. Es así como los desarrollos matéricos, de cara al futuro, viran hacia tecnologías donde la sostenibilidad de la vida es central, mediante utilización de materiales biodegradables, respetando los ciclos naturales de regeneración

Palabras clave: materiales biobasados, construcción sostenible, género, ecología.

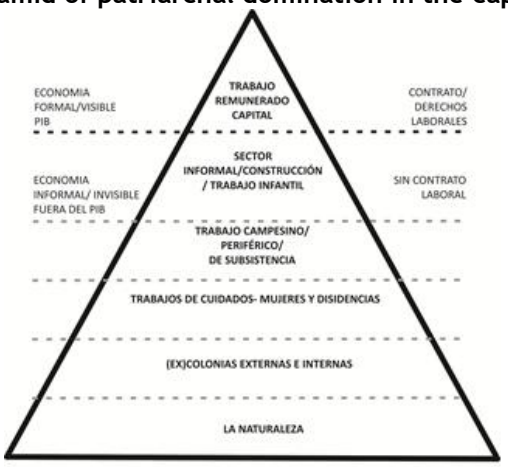
INTRODUCTION

The urgent environmental crisis

Currently, a large part of the resources that sustain human life are in detriment. Oil, the energy base of productive and economic organization, is beginning to show signs of depletion and its constant extraction process does not respect the geological times of natural regeneration of fossil resources, sowing doubts about the continuity of a social and economic system that is a high consumer of energy (Herrero, 2012). Ecofeminism is a relatively recent current of feminism, about 50 years old, which highlights the links between the subordination of women and other unprivileged social groups (such as people of color, poor, LGBTI+ or indigenous people, for example) and the exploitation of the non-human living world, i.e. nature to respond to the demands generated by the current extractivist production model (Herrero Cabrejas, 2017).

The use in just a few decades of huge amounts of fuels has thrown into the atmosphere huge volumes of carbon that remained sequestered in the subsoil or seabed, so that the cycle that regulates carbon has been profoundly transformed. Climate change is one of the consequences of the alteration of these cyclical dynamics of the biosphere. Globally, the construction sector is currently one of the most polluting industries; it can be estimated that 40% of pollution is directly or indirectly linked to construction activities (García-Ochoa, Quitp-Rodríguez, and Perdomo Moreno, 2020). In this sense, there has been little discussion on the materiality and practices from which cities are built and the need for shelter and housing is met. Figure 1 shows how nature, considered as something alien to the human, is placed at the base of the patriarchal domination pyramid, where priority is given to paid, formal work that generates and accumulates capital.

Figure 1. Pyramid of patriarchal domination in the capitalist model



Source: Own elaboration based on adaptation of Bennholdt-Thomsen and Mies (1999: 31).

METHODS

Ecofeminism and Capitalocene as two categories of analysis.

Ecofeminism(s), as situated political and activist practices, make up a social movement and a diverse current of thought that explores the synergies between feminisms and ecologies, developing a radical critique of the capitalist model from the position in which it is affirmed that, in order to sustain life, it is necessary to recognize the interdependence of human life (Herrero, 2015). Thus, this movement highlights an integrated humanity dependent on the ecosystemic context it inhabits, at a particularly dramatic moment in history in which the planet's capacity to sustain us is overwhelmed.

There are several positions or approaches within ecofeminism: the essentialist or classical, the constructivist, spiritualist, queer, animalist, etc. The first holds that women have biological traits (such as the ability to give birth or menstruate) that link them in a more intimate and special way with nature. This approach can be dangerous because it reinforces some gender stereotypes that justify that women should perform care tasks because of a natural role assigned to them that is functional to patriarchy. The second position considers that the subjugation of women and nature has to do with a social construction of both as territories of conquest. The limits of the rest of the approaches are diffuse and in some cases causes and concepts are intertwined, however they all share the denunciation of the androcentrism of science and history for the exclusion of women and non-privileged groups, and of the patriarchal domination of nature (Herrero Cabrejas, 2017). In Latin America, women from rural contexts and native peoples who organize to lead peasant struggles against extractivisms are considered a reference for the ecofeminist movement, recalling the ancestral practices of Buen Vivir as an alternative to bad development (Gudynas and Acosta, 2011).

From a critical view of the prevailing epistemologies, according to Marías Mies in Ecofeminism, there is a crisis in science where currently there is a sin of reductionism and regeneration (Shiva and Mies, 2021). However, in parallel to this criticism, the authors point out some methodological proposals for ecofeminist research, among which they suggest replacing the postulate of research devoid of values, neutrality and modern indifference towards the object of study with an interdependent understanding of life that is inevitably closely linked to the person who observes and constructs knowledge. In this way, it reaffirms the idea that “the personal is political”, a common slogan in which the personal is political. a

common slogan in which different views from feminist movements, mainly of a radical nature, converge [(1)].

In this line, it is proposed to enable criticism and perspectives on how the environmental crisis, from an ecofeminist perspective, is articulated with patriarchal gender inequality and oppression, and also, to relate the historical-geological moment of the Capitalocene with the knowledge and experiences of these unprivileged social groups, facing the need to build their habitat and propose materialities that prioritize life support as opposed to the hegemonic market logics that consider housing as a good and not as a right.

This paper explores the possibility of reflecting on two fundamental aspects of these issues: I. On the one hand, the technologies of production of construction materials and their relationship with the Capitalocene; II. On the other hand, the alternative material practices in accordance with the ecofeminist struggle(s) as a proposal of resistance to the environmental crisis.

DEVELOPMENT

Building materials production technologies and their relationship with the Capitalocene

The Anthropocene concept, as a predecessor of the term Capitalocene, refers to the power that human activity has acquired to become a destructive environmental force of geological scale (Crutzen, 2006). This concept has gained much traction, forming a field of discussion. As a result of this debate, another concept has emerged to replace it: the Capitalocene. In this case, it is considered that the destructive power does not come from human activity in the abstract, but from its capitalist organization and the productive model associated with it (Ulloa, 2017).

To speak of Capitalocene implies taking distance from the diagnoses that point out that the origin of the current socioecological crisis is anthropogenic, assuming that the human is a homogeneous whole or a fictitious unit in which particular responsibilities and concrete forms of intervention, appropriation and co-production in the fabric of life are blurred (Navarro Trujillo, 2022). Capitalism has reduced labor and the worker to the category of just another input. A raw material that it calls “human resource”, which suffers the same fate as any other when the numbers do not close and profits are compromised (Haraway, 2016). This conception has brought humanity to a limit point, in which a growing proportion of the world's population is expelled from the productive system and condemned to hunger and destitution. And this is a definitive expulsion: the techno-economic paradigm of “free” trade aims to steadily reduce jobs. In other words, the problem is the Capitalocene understood as a geological era dominated by capital and its infinite logic of profit accumulation (Moore, 2013).

This reflection, is nourished by the urgent need to put at the center the care of human and non-human life, from the spaces in which ecofeminism and its multiple variations, from different actions strive to guarantee and sustain, in an autonomous and self-organized way the material and symbolic conditions of their existence, in the midst of the violent processes of dispossession and precarization that capital imposes on us daily (Navarro Trujillo, 2021).

Giving meaning to the field of materials engineering from a gender perspective suggests that no technology in the environment that surrounds us is innocuous or neutral, from the food we consume and the packaging that contains them to mobile devices and electronic appliances. Even less are the ways of

[1] Consigna y bandera del feminismo radical. In her essay on the origins of radical feminism, Alicia Puleo analyzes the work of Germaine Greer in The Whole Woman.

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producing and co-producing the habitat exempt from non-neutrality. The equation is simple: the less knowledge we have about how technologies are composed, how they are manufactured and how to use them, the greater the dependence (Massuh, 2010). In addition to this, it becomes urgent and necessary to know the environmental impact that the excessive production and reproduction of these technological objects and materials necessary for the habitat produce on ecosystems. In this sense, incorporating the analysis of the life cycle of materials and their capacity for biological degradation is central to this approach (Arena, Basso and Fernandez Llano, 2006).

It is of vital importance to define and delimit very well which things are manufactured, which are really needed and how they are distributed. The Capitalocene era has exceeded the biological limits of the earth to favor only a tiny fraction of humanity. If we continue along the same path with the current productive system, the day may come in the not too distant future when the complex structure of the biosphere, the one that shelters us as humanity, will no longer be a place worthy of being inhabited.

The carbon footprint of traditional building materials

Undoubtedly, ecofeminist thought has contributed to the production of anti-Cartesian epistemes, recognizing that no organism can live without symbiotic relationships with other species for the construction and (re)production of habitat. The society/nature differentiation allows a supremacy of the former over the latter, which is reduced and can become an object of domination, conquest and plunder. Modern science ends up ignoring the complex order and the ecosystemic and collaborative organization of the organic cycles that promote the sustenance of life. In this line, the mechanistic and physical vision of the world is based on the murder of nature as a living organism and its transformation into a great reservoir of “natural resources” or “materials” that can be analyzed and synthesized. The nature of the materials affects the total embodied emissions from a virtual and physical perspective. Virtual carbon” represents emissions related to the manufacturing process and the use of specific fossil energy resources and chemical processes. Cement and steel account for most of the virtual carbon (García-Ochoa, Quitp-Rodríguez and Perdomo Moreno, 2020).

The current production system is a true entropic accelerator. It consumes huge amounts of fossil energy, which will never again be available, disrupting the complex structures of soils and ecosystems. It thus destroys the natural architecture that ensures the existence of life, simplifies the trophic chains that ensure the flow of solar energy before it is irretrievably lost through dissipation, and breaks the great biogeochemical cycles, preventing the recycling of finite materials and altering the bases that regulate the climate. All these factors, together with the accumulation of waste and the unplanned growth of cities, accelerate and aggravate climate change.

Science and technology are part of the social context in which engineering develops and are by no means separate from it. The variety of meanings people have for them has a historical nexus in our society. Some studies point out that many men perceive the acquisition of technical skills by women as a threat to masculinity and to the traditional gender order (García, 2002). On the other hand, constructive systems with traditional materials are mostly executed by men, however, there are more and more women and dissidents with constructive trades. This panorama does not escape the gender bias of construction activities, in which there is a masculinizing cultural component in which it is maintained that in order to perform masonry tasks or construction-related trades, strength, physical resistance and muscular weight are required. Thus, technological developments aimed at solving habitability problems, from an ecofeminist perspective, could be linked to the possibility of turning towards technologies that place the sustainability of life at the center, that is, the use of materials that can be sustainable, manipulated by diverse gender identities, biodegradable and capable of being absorbed by natural cycles. In the same

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way, activities related to construction, construction technologies and systems and components used in housing, could be diversified so that they can be carried out by women's and dissidents' crews.

Alternative material practices in line with the ecofeminist struggle(s) as a response to the environmental crisis

Material Resistances: The new biodegradable plastics

Visualizing our world today without plastic is practically impossible. Plastics have revolutionized our lifestyles and consumption (Rodriguez and Barragán, 2008). In the construction field, they are also used, with multiple applications, but in larger volumes as thermal and acoustic insulation. All engineered materials are colonized by microorganisms (mainly bacteria and fungi) within hours after exposure in natural waters and in many atmospheric environments. The microorganisms grow and produce a viscoelastic layer or biofilm. In general, this is often considered a disadvantage against a notion of architecture that should transcend and remain over time. However, many vernacular architectures understand biodeterioration as part of life. Houses “die” once they have fulfilled their function of shelter or particular use.

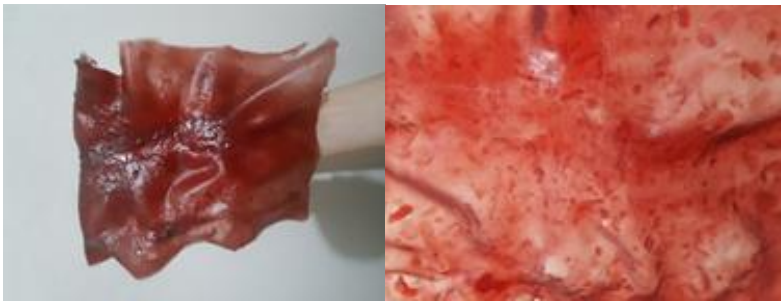
In this sense, the more difficult the building materials are for environmental microorganisms to degrade, the more of a problem they become. At present, 40% of the volume of waste in landfills and dumps is construction waste, which, when not reused as debris, is moved and becomes part of sanitary landfills or garbage in sacrifice zones. In response to these problems, a series of experimental developments are mentioned that contemplate the biosynthesis and cultivation of raw materials, such as, for example, bioplastics obtained from starch and organic waste, bioluminescent devices using organisms that emit fluorescence, insulating structures of fungal mycelium, or cementation induced by microorganisms, which have the ability to regenerate themselves (Mayoral Gonzalez, 2015).

RESULTS AND DISCUSSION

New Biomaterial Practices: Towards an Architecture of Finitude

Currently there is an activism from the experimentation and development of bioplastics, among which we can find the contributions in Argentina of Ana Laura Cantera and Laura Messing in the field of art, the experimentations of the Superpraxis studio in the field of architecture and CEVE in terms of research and development of these materials evaluating their physical and mechanical properties. The biodegradable films shown in Figure 2 were developed from workshops given by these referents.

Figure 2. Bioplastics based on starch and organic residues.

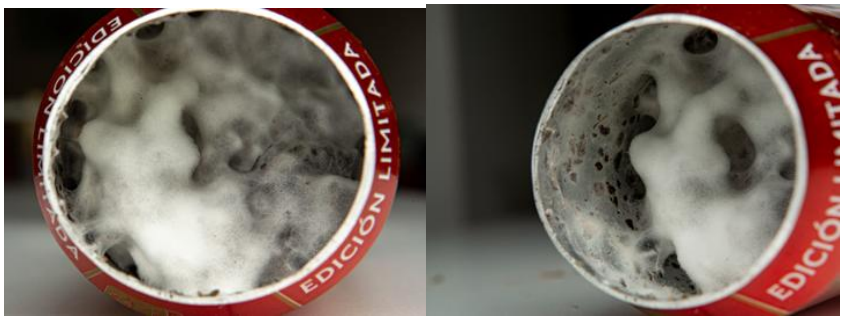


Source: Own elaboration.

To generate alternatives in the field of habitat, cellulosic waste available in the local environment is recycled with fungal mycelium to obtain a biotransformed organic material that can be applied in plates for thermal insulation and enclosures (Fernández, Gaggino, Kreiker and Positieri, 2022). Figure 3 shows

biopolymers based on fungi and recycled cardboard growing in a molding can in the form of specimens that will later be subjected to standardized tests.

Figure 3. Development of insulating materials based on fungal mycelium.



Source: Own elaboration.

Addressing the specific technical issues for the production of building components with environmentally friendly materials implies a paradigm shift in terms of the established concept of immutable and durable housing. Construction waste should be able to be absorbed by nature in a short period of time. Based on the search for new biodegradable materials within the framework of the Capitalocene, mycelium applied as a thermal insulation material in housing can be beneficial to promote the reduction of energy poverty in homes, and at the same time be a soil enriching agent and a generator of biological associations that contribute to guaranteeing the continuity of life.

In order to reflect on the above, a series of triggering questions are presented:
- On the one hand, on traditional building systems and patriarchy: Would it be possible to turn towards more inclusive ways of building and inhabiting for all?
- On the other hand, on the "transcendence" of our cities: Is it necessary that part of our obsolete cities, once their useful life is over, end up in landfills as eternal waste, thus changing the composition of the soil?
- On the permanence of architecture: What alternatives are there to the materialization of "forever" architectures? What would a "finite" architecture look like?
- And finally, on traditional materials as opposed to new biodegradable materials: Is it possible to design materials from ecofeminist logics of "life at the center"? What role do microorganisms play in the face of environmental and habitability problems?

CONCLUSIONS

From the ecofeminist practice, it is possible to rethink building technologies in terms of sustainability and as a tool for emancipation. If we contemplate natural cycles, it becomes necessary to recognize the disciplinary fields as an interconnected plot, in which everything is related to everything else. Materials engineering could be considered a practice nourished by other fields of knowledge, collaborative work or transdiscipline. In particular, I propose to reflect on architecture as an action through the engineering of the living and the inert, in which it is worthwhile to turn towards regenerative and finite architectures from a material conception -and care- of the elements with which we build, analogous to the modes and times with which nature materializes.

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CONFLICT OF INTEREST

None.