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作品編號 200017
參展科別 環境工程
作品名稱 Prismalla: Mist water collector
得獎獎項 四等獎

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關鍵詞

ABSTRACT:

The lack of drinking water in human settlements triggers a series of problems that are linked and affect the development of humanity: health problems, lack of water security for companies, lack of jobs, insecurity, among others.

We observe this problem in the communities of the municipality of Las Vigas de Ramírez, Veracruz, where there is a great problem with the water supply, although there is a high presence of mist. Faced with this situation, we undertook the task of investigating a water harvesting method that is easy to implement, operate and maintain.

We investigated and analyzed the methods of mist condensation through physical barriers, finding that the polyethylene shadow mesh was the means to achieve this, because it allows the passage of the wind, it is very light, easy to manipulate and above all that it presents the phenomenon of percolation that allows water droplets of various diameters to be accommodated therein.

We designed a device that allows to present a mist catchment area through a prismatic structure enabled with meshes and condensed water receivers, portable, easy to use and maintenance and very economical with a performance of 20 liters per day.

To achieve our project, factors such as air humidity, dew point, wind speed and direction, height, temperatures and available spaces must be considered.

1. INTRODUCTION.

As we know, 75% of our planet is made up of water, which apparently has dictated the existence of life on our planet. Being this fundamental resource for the life of any living being and essential for humans.

Currently, accessible and affordable drinking water for humans is much less than it was a few years ago, due to different causes such as overpopulation or contamination than the cyclobiogeochemical of the water.

The lack of drinking water in human settlements triggers a series of problems that affect the development of humanity: health problems, lack of water security for companies, lack of jobs, insecurity, among others.

We observe this problem in the communities of the municipality of Las Vigas de Ramírez, Veracruz, a place to which I have access because my family works in that area. Talking with local inhabitants, they told me that there is a big problem with water since the authorities are not in charge of properly distributing the resource, many told me that they used rainwater recovery methods but it is very complicated and intermittent. Faced with this situation, we undertook the task of investigating a better capture method and thus help the community with this serious problem, a method that was inexpensive and easy to implement, operate and maintain.

The performance of our collection method depends on the environmental and design variables, in my research I found different products used for this problem, however many were not practical and needed to be fixed in the same place and in the same direction, which decreased its performance. capacity, that's why I had the idea to make a prism covered with this mesh, which will help us to condense the mist from whatever direction it comes from, we can also put it almost anywhere and it has a quick disassembly system that helps people to transporting it from one place to another very easily, thus allowing to have a low-cost, easy-to-use and maintenance-friendly system, but above all high performance.

If our Prismalla is handled correctly we will achieve a yield of 3 to 5 liters per day per square meter.

1.1 JUSTIFICATION.

The lack of drinking water in human settlements has triggered a series of social and economic problems that end up impacting the environment, but especially people's health.

In the communities of the municipality of Las Vigas de Ramírez, Veracruz, there is a great problem with affordable drinking water, the authorities are not facing the situation with clear effective and efficient development policies. Some inhabitants try through rainwater recovery methods to obtain the liquid, but it is very complicated and intermittent. Knowing this situation, we gave ourselves the task of investigating a better method of obtaining water and thus

helping the community with this serious problem, we needed a method that was economical and easy to implement, operate and maintain.

Since we focus on the community of Las Vigas de Ramirez, municipal seat of the municipality with the same name, a town located at 2,420 meters above sea level in the central mountainous area of the state of Veracruz, mountains belonging to the Cofre de Perote mountain range, a national park, belonging to the cloud forest ecosystem, we consider that due to its location the displacement of very cold air masses from the north, which, when meeting the region's air masses (hot and very humid), cause the most intense fogs / dense but rain is scarce.

So we justified perfectly the existence and relevance of our project, helping people to have water.

1.2 STATEMENT OF THE PROBLEM.

Currently, accessible and affordable drinking water for humans is much less than it was a few years ago, due to different causes such as overpopulation or contamination than the cyclobiogeochemical of the water.

The lack of drinking water in human settlements triggers a series of problems that are linked and affect the development of humanity: health problems, lack of water security for companies, lack of jobs, insecurity, among others.

We observe this problem in the communities of the municipality of Las Vigas de Ramírez, Veracruz, a place to which I have access because my family works in that area. Talking with local inhabitants, they told me that there is a big problem with water since the authorities are not in charge of properly distributing the resource, many told me that they used rainwater recovery methods but it is very complicated and intermittent. Faced with this situation, we undertook the task of investigating a better capture method and thus help the community with this serious problem, a method that was inexpensive and easy to implement, operate and maintain.

1.3 HYPOTHESIS.

The equipment developed (Prismalla) at low cost and easy operation allows to collect the water from the mist in the Municipality of Las Vigas de Ramírez in the state of Veracruz in an economical, efficient and practical way.

1.4 OBJECTIVES.

General objective:

Recover water from mist with the help of the shadow mesh prisms.

Specific goal:

Establish new water collection alternatives.

Help the community in the service of water.

2. THEORETICAL FRAMEWORK.

There are various equipment for the collection of water from the mists in our country and in America, however they are fixed, complex and high-cost equipment that does not contemplate that the handling of these will be carried out by residents who sometimes do not know how to read or write, so they end up abandoned and useless.

There is work done in the Atacama desert in Chile, Ecuador, Guatemala, Peru, Nepal, Israel, and some countries in Africa.

In Mexico this procedure is not very popular due to the lack of public policies of local governments to promote them, although there are isolated studies and reports in some magazines have not considered this type of procedure as economically viable alternatives.

Because they involve skilled labor and high operating costs, in addition to not being able to move them from their location.

3. METHODOLOGICAL PROCESS OF THE DEVELOPMENT OF THE PROJECT.

The development of our project is thanks to the scientific method whose parts are observation, research, hypothesis development, experimentation, results and conclusions.

We focus on the community of Las Vigas de Ramírez, municipal head of the municipality with the same name, a town located at 2,420 meters above sea level, located in the mountains belonging to the Cofre de Perote mountain range, a national park, belonging to the cloud forest ecosystem, Due to its location, the displacement of very cold air masses from the north, which when meeting the air masses of the region (warm and very humid), cause the most intense / dense fogs but rain is scarce.

Given this situation, we analyze that the mist is water vapor, which could be condensed. There was the key to our project, how to make that water in the form of gas could be condensed or harvested in order to be delivered to the inhabitants in a liquid and safe form.

After investigating and analyzing the methods of condensation of water vapor through physical barriers, we found that the polyethylene shadow mesh was the best means to

achieve this because it allows the passage of the wind, it is very light, easy to manipulate and above all that it exhibits the phenomenon of percolation that allows water droplets of various diameters to be accommodated therein.

We designed a device that would allow a mist catchment area to be presented by means of a prismatic structure of 2 X 3 meters per face fitted with mesh and condensed water receivers, which could be portable and easy to use and maintain, as well as mobile and very economical.

The mesh used in our project is 50% raschel mesh for shading crops and nurseries from the HORTOMALLAS family, OBAMALLA brand with Raschel fabric / flat thread of Polyethylene material stabilized against UV Rays and which provides a coverage of 50% of shade.

The Prismalla structure was built with recycled wood with an actual height of 4 m and a width of 2 m.

Through its structure, the mesh would help us to harvest the water by retaining tiny drops of water, which are not large enough to precipitate (1-40 microns- μm) but accumulate in the network until they form more drops. Large ones that, due to their weight, fall by gravity and are collected by a pvc gutter with a diameter of 5.03 cm along the entire base of the mesh of each face of the prism towards a storage area.

To achieve our project, factors such as air humidity, dew point, wind speed and direction, height, temperatures and available spaces had to be considered.

The test work was carried out during the months of February and March 2020, before the pandemic began.

In these months the presence of fog is high, starting from 4:00 p.m. on average until 7:00 a.m. the next day.

The performance of our collection method depends on the environmental variables and the design, in my research I found different products used for this problem, however many were impractical and needed to be fixed in the same place and in the same direction, which decreased their performance capacity, that is why I had the idea of making a prism covered with this mesh, which will help us to condense the mist from any direction that comes, we can also put it almost anywhere and it has a quick disassembly system that helps to people to transport it from one place to another very easily allowing with this to have a low cost, easy handling and maintenance but above all high performance system.

If our Prismalla is handled correctly we will be able to obtain up to a performance of up to 20 liters per day for the entire system.

4. RESULTS.

The results we obtained were that when occupying six square meters of mesh, an average of 5 liters per day were obtained, which corresponds to one face, since it is a prism we multiply this value by 4 and we obtain a use of up to 20 liters per day.

5. ANALYSIS OF RESULTS AND DISCUSSIONS.

Our functional prototype that we used was highly effective, since if we consider that it has an approximate construction cost with new materials of \$ 75 dollars, it solves the water problem of a family in an effective way, since it can produce the equivalent of a jug of water daily. A jug of water has an approximate cost in the market of \$ 1.50 dollars, resulting in an equivalent of 500 jugs, if we consider that in this area they do not sell jugs and that they would have to go to the city it would have a higher cost for transportation or a large physical effort if you have to walk.

Due to the lifestyle of the community where the project was tested, we know that a family of 6 people, which is the average in this area, consumes up to 3 jugs a week only in the kitchen, since in the absence of water they occupy it for almost everything except for bathing.

This represents a direct cost of \$ 4.50 dollars per week. In week 16 the cost of Prismalla would be paid.

It is necessary to carry out a study of the quality of the water obtained, since if it is useful for irrigation and animals, we must observe certain purification actions to the water obtained so that it is optimal for human consumption.

5.1 FUTURE LINES OF INVESTIGATION.

It is planned to carry out a filtration process with natural resources such as gravel, earth, sand, textile fibers, activated carbon in order to ensure the potability of the water obtained.

6. CONCLUSIONS.

We effectively achieve the harvesting of mist water in a region where liquid is scarce, through a low-cost, high-efficiency equipment that is especially easy to operate and maintain.

It is necessary to start with the work of creating a natural filter that accompanies the system to ensure the potability of the water for consumption.

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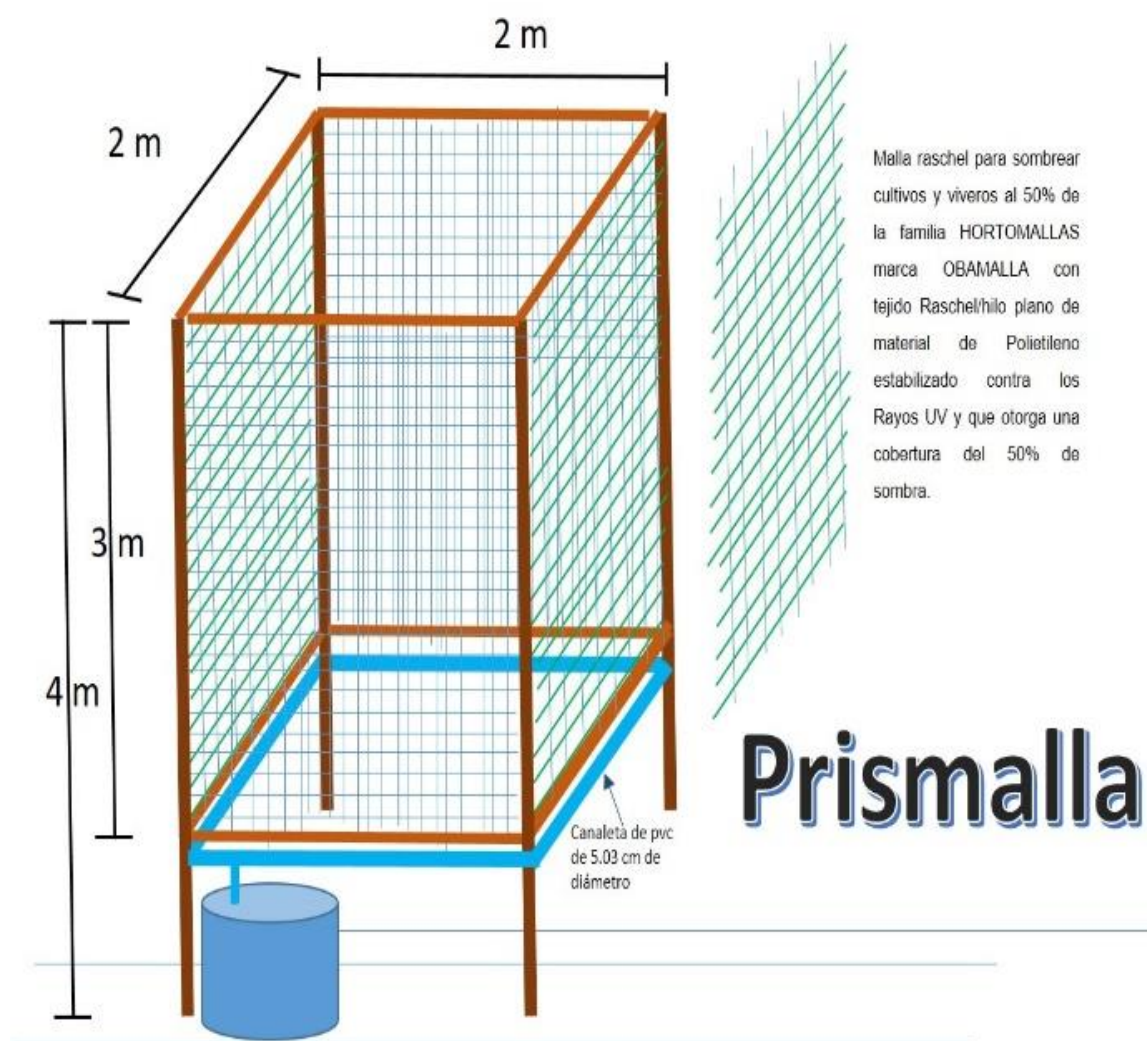
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8. ANNEXES

Table 1. Results of liters obtained per square meters.

<i>Square meters of mesh</i>	<i>Amount of water obtained (ml)</i>
2 m ²	1,500 ml
4 m ²	3,000 ml
6 m ²	5,000 ml
24 m ²	20,000 ml

Figure 1. Prismalla



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The research topic is interesting and important. Further research should be conducted to evaluate the effect of relative humidity, temperature, and wind speed on the water collection efficiency.