Model to Determine Humidity Level of Cloud Seeding for Agribusinesses in Mexico City

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Abstract

Non-renewable resources are being depleted at a faster rate and consequently can cause a strong asymmetry in marginalized cities and towns, a resource as vital as water is a gift of nature that is not valued as it deserves, and the lack of it can be a high-risk factor causing serious economic, social, and health problems (UNHCR 2019). That is why the research objective is to design an industrial application model for the capture of atmospheric water, focused especially on agribusinesses in Mexico City. The design of the model is based on the models of Cloud Seeding (Super and Heimbach 1983) and Fog Trapping (Bautista et al. 2018), applying the analytical mechanics model (Zayas 2019). The main contribution of this research is that the proposal of this model supports the fulfillment of three Sustainable Development Goals of the 2030 Agenda: SDG 2. Zero Hunger; SDG 6. Clean Water and Sanitation and SDG 9. Responsible Consumption and Production.

Keywords
Cloud Seeding, Fog Sublimation, Atmospheric Water, Agribusiness and Mexico City.

1. Introduction
Over time, agribusinesses have had to develop and innovate their processes to be competitive; it is vitally important to seek and promote numerous opportunities for generating employment and income. The demographic growth of the world's population obliges this sector to ensure that the land is used, and that the product obtained from it is of better quality coupled with the satisfaction of demand (IICA 2017).

It is worth mentioning that agribusiness has an enormous potential to employ the rural population by combating poverty in rural and urban communities (FAOAquastat 2014) which is not only at the agricultural level, but there are alsoseveral opportunities, derived from processing, handling, marketing, and transportation. Agribusiness has a strong economic impact on the world. However, less than 3% of the world's water is fresh, and only 0.5% is used to meet all human needs (UN 2021), including agribusiness, since, on average, agriculture uses 70% of the water withdrawn in the world, and agricultural activities account for an even higher proportion of "consumptive water use" due to crop evapotranspiration. Globally, more than 330 million hectares are irrigated. Irrigated agriculture accounts for 20% of the total cultivated area and contributes 40% of the world's total food production (World Bank 2021), making the increasingly excessive use of the vital liquid and the infrastructure needed to manage it highly costly, aggravating global scarcity (UN 2021).

Competition for water ownership is expected to increase in the future, focusing its greatest pressure on agriculture. To support economic growth, major changes in water allocations are needed. Agribusiness, as the axis that moves value networks, has performed well in the Mexican economy, as it is one of the most important aspects of the country's development (FIRCO 2017). However, due to population increase, urbanization, industrialization, and climate change, the improvement in water use efficiency must be accompanied by water supply in regions with water stress ranging from 25% to 40%. In most cases, the supply is expected to come from agriculture due to its high share in the consumption of the vital liquid (World Bank 2021), so innovations in agribusiness are essential to be more efficient (Herrera2006).In the last decades, water harvesting models by Cloud Seeding (Super and Heimbach 1983) and by Fog Trapping (Bautista et al. 2018) have been successfully used to generate a greater volume of water in certain regions of the world, depending on each region and its climate, temperature, and humidity conditions.

1.1 Objectives

The objective of this research is to design a model to determine the level of humidity obtained by cloud seeding and fog capture techniques for agribusinesses in Mexico City.With a structure based on Cloud Seeding (Super and Heimbach 1983) and Fog Trapping (Bautista et al. 2018) techniques, applying the analytical mechanics model of (Zayas2019), this paper presents a cloud seeding model design focused on agribusinesses in Mexico City intending to use the relative humidity of the region to combat water scarcity and that is accessible to agribusinesses.In this sense, to achieve the objective, 2 phases will be carried out:

1. Define the measurable variables based on the data from each water catchment system.

2. Determine elements to design the model for Mexico.

2. Literature Review

Since late 40s one of the most complicated mechanical problems studied is about the dynamic of raindrops(Day and Ghorai 2022).Nowadays, the quantification of the efficiency of cloud seeding still represents achallenge, although human weather modification is a method to develop precipitations to benefit local society. (Xiaobo et al. 2021).To reduce the shortage of drinking water, scientists have suggested artificial rainfall, which can be a way to overcome the water shortage. Many types of research have been conducted on cloud seeding and all of them have shown a positive effect on raising the humidity level and water uptake (Misra and Tripathi 2021).

It is well known that freshwater comes from the atmosphere, regardless of whether it remains on the surface or goes underground, however, not all the water present in clouds is precipitated. Therefore, the possibility of increasing the water supply has been investigated through the technique of cloud seeding whose purpose is to initiate as well as accelerate the precipitation process. The result is an almost immediate increase in the amount of rainfall in the chosen region or locality (Sudhakar and Satyanarayana 2021).

The dispersion of chemicals such as silver iodide, carbon dioxide, and other agents (Yuan et al. 2021), in clouds, allows condensation, which in most projects successfully reflects a considerable increase in precipitation. The most used method for cloud seeding is the use of rockets and burners, located on the ground (Willers 2022).The chemical condensation agent (seeder) is then launched into the target cloud. However, it is also possible to perform flights around the target region and spray the seeders in the cloud (Yuan et al. 2021).

The agribusiness model emerged in the 1990s in the South American region and was consolidated until the 2000s supported by technology, the financial, productive, and organizational system, which allowed a network dynamic redistributing productive risk in different regions and activities (Gras and Hernández 2020).Actually, scientists have been replicating new models and projects in North America regions too (Tuftedal et al. 2022).

Over time, agribusiness has had to develop and innovate to be competitive; it is vitally important to seek and promote numerous opportunities to generate employment and income. The demographic growth of the world's population forces this sector to ensure that land is exploited, and that the product obtained from it is of better quality and satisfies demand (FAO 2013).

It is worth mentioning that agroindustries have a great potential to employ the rural population, not only at the agricultural level, i.e., there are opportunities for processing, handling, marketing, and transportation. Agro-industries have a strong impact on the world in economic matters, one third of the food produced is equivalent to 1,300 million tons with a value of 1,000 million dollars (MDD), (UN 2021). In addition, it contributes to combating poverty in rural and urban communities (FAO 2013).

In addition, nowadays exist another concept for agribusiness, "Inclusive Agribusiness (IAB) that corporations and independent experts alike consider important to achieving sustainable and equitable development for small farmers. Schoneveld (2022)mentions that the businesses that productively integrate small farmers into commercial agrifood chains, IABs could help resolve some of the coordination and market and input access problems confronting many rural economies. They are therefore increasingly regarded as important private innovations to address systemic inequalities and inefficiencies within modern food systems. On the other hand, land degradation, soil erosion, and water unsustainability, strongly diminish the capacity of natural resources to provide food (UN 2021).

The importance of agribusiness in Mexico is quite significant, despite the ravages of the pandemic caused by the SARS COV-2 virus, there are records that, up to the third quarter of 2021, a surplus of 5,415 MDD was achieved, according to the Ministry of Agriculture and Rural Development. The Bank of Mexico reported that total figures for the agri-food sector in Mexico reached 60,092 MDD, of which 54.5% correspond to sales made in the country, generating a positive balance of 1,046 MDD (Industrial Cluster 2021).According to the latest figures registered with the National Water Commission (CONAGUA) 76% is used for activities related to agribusiness (FCEA 2017).

Mexico City is one of the most sophisticated metropolises in the world. However, it is one of the most important producers of nopal cactus in the country, as well as an influential producer of grains such as amaranth and corn, as well as medicinal herbs and rosemary. Despite being a developed city, the means of production are executed through chinampas, which are floating crops that have existed since the origins of its civilization, which have been perfected over time and have significantly increased their production capacity. Based on data from the Food and Agriculture Organization of the United Nations (FAO 2020), the economically active population employed in agribusiness amounts to 16,000 people, in 11,543 family production units and around 22,800 hectares (ha) of land are destined to crop production, of which those located in the mayoralties of Tlalpan, Milpa Alta, Tláhuac and Xochimilco stand out. It is relevant to mention that in the report "Greenest Cities in Latin America and the Caribbean" the harvest in Mexico City (CDMX) has reached an estimated value of more than 100 MDD thanks to the production of nopal, oats, fodder, potatoes, broccoli, carrots, among others. Agriculture in the CDMX has been adapting thanks to the innovation of producers (Sánchez 2019).The Sustainable Development Goals related to agribusiness are Zero Hunger, Clean Water and Sanitation, and Responsible Consumption and Production, as shown in Table 1.

Table 1. Impact of Agribusinesses on the Sustainable Development Goals

SDG 1	SDG 6	SDG 12
Agribusinesses are the largest employers in the world, as they are a source of income for 40% of the population. There are more than 500 million small farms around the world, producing 80% of the food consumed in developing countries. This is why we need to encourage investment in small agribusinesses, as well as in farmers.	The lack of access to drinking water in some indigenous peoples and marginalized areas leads to a sad reality in which girls and women are responsible for collecting water in 80% of the homes. Severe water scarcity significantly impacts more than 40% of the population and this percentage is expected to increase. Approximately 70% of the water withdrawn is used for irrigation; however, up to 80% of wastewater is discharged untreated into rivers and seas.	If by the year 2050 the world population reaches 9.6 billion, 3 planets would barely be enough to maintain the current lifestyle. Less than 3% of the water available in the world is fresh, and 2.5% is frozen in Antarctica, the Arctic, and glaciers. That is, the remaining 0.5% is to meet human needs, 76% of which is used for agribusiness, resulting in an increasingly accelerated increase in anthropogenic pollution, challenging nature's ability to purify and recycle water from lakes and rivers and aggravating global water scarcity.

Source: Own elaboration with data from (UN, 2019), (UN, 2021), (UN, 2021b), (UN, 2021c).

It is increasingly common to see operational cloud seeding programs being replicated in several countries in response to the scarcity of water resources that have invested in the research and development of weather modification applications to increase the volume of natural rainfall (Kong et al. 2021), especially in arid and water-scarce regions, especially in arid and water-scarce regions, including experiments in the United Arab Emirates (UAE) which consisted of bombarding clouds with Silver Iodide using drones in China(Al Hosari et al. 2021; Yuan et al. 2021; Weiguo et al. 2021).

In the UAE, aerial and ground-based interventions in cloud microphysical processes improved precipitation by increasing the natural amount of rainfall through hygroscopic seeding of warm clouds involving an introduction of large artificial aerosol particles that increase liquid uptake(Farahat and Abuelgasim 2022), intending to mitigate the effects of high temperatures that exceeded 50°C, larger seeding particles are expected to trigger a "competition effect" that favors the production of large droplets that can activate the collision-coalescence process and enhance precipitation generation." (Al Hosari et al. 2021; Zangana et al. 2021).

Analogously China to commemorate the 70th anniversary of its national day applied an experiment in Mongolia to stimulate rainfall and reduce pollution levels. The result of the experiment provides evidence that rain seeding has the potential to monitor the microphysical process of cloud precipitation (Yuan et al. 2021; Jin et al. 2022). In Mexico, there are historical records dating back to 1983 in which the first scientific advances closely related to the intention of generating rain, which has been initiated since the 1940s, were reported (Ramos 1983). However, it was not until the 1980s when it was called "Cloud Seeding" (Super and Heimbach, 1983), and its a translation into Spanish as "Siembra de Nubes". The most recent data were recorded from March 27 to April 20, 2021, when a forest fire in the state of Nuevo Leon could not be extinguished or controlled, it was then when the Ministry of Agriculture and Rural Development in coordination with the Mexican Air Force carried out the bombing of Silver Iodide in the clouds over the affected municipalities to generate rain, using the limited amount of 100 liters of silver iodide in solution with acetone that when interacting with the climatic conditions was able to quench the fire (SEDENA 2021).

One of the disadvantages that arise from the cloud bombardment method is that the inputs required to execute it (silver iodide, airplanes and the infrastructure to operate them, highly skilled labor, among other resources) are very expensive to operate, making it not very viable for agribusinesses (Lei et al. 2022) and (Siyao et al. 2022). One of the alternatives to cope with the high operating costs have resulted in the creation of other methods such as active fog collectors which need electrical energy to operate the evaporator, in contrast, the passive water collector does not need electrical energy to comply with its operation, these devices take advantage of the relative humidity of the regions for the concentration of water for domestic use. However, there are no conclusive records of use cases of this technique in Mexico City for agricultural purposes (Bautista et al. 2018).

Finally based on literature focused on cloud physics, in which the American Journal of Physics (Zayas 2019) proposes an analytical mechanics model to know the falling velocity of a water drop, as well as its volume (American Journal of Physics 1986), which will serve to delimit a frame of reference of where is the correct position to place the device to collect the largest possible volume of water.

3. Methods

The method applied in this research was developed from the search for information regarding cloud seeding, how it arose, who executes it, where it is executed, how it is executed, experiments conducted at the national and international level, as well as the analysis of the results obtained, based on previous research it was deduced that the operating cost to precipitate rain is very high, In contrast, it was found literature of devices for fog collection in areas with relative humidity in the range of 75-100% (Liu and Shi 2021), which is favorable for the use of the model to determine the humidity level of Cloud Seeding for Agribusinesses in Mexico City, since the device concentrates the fog inside and channels it to a collection tank.

For this reason, the possibility of obtaining a greater water catchment will be sought through the construction of a water catchment model based on the models of (Super and Heimbach 1983) and (Bautista et al. 2018), applying the analytical mechanics model of (Zayas 2019) and (I. Adawi 1985), whose proposal allows knowing the falling speed of a drop of water, as well as its volume, which will serve to delimit a frame of reference of where is the correct position to place the device to collect the largest possible volume of water.

4. Data Collection

Two phases were carried out:
Phase 1. Define the measurable variables based on the data from each water catchment system. Successful cases of cloud seeding, and fog sublimation models were sought, such as those applied in the United Arab Emirates, China, and northern Mexico by bombardment using silver iodide and active and passive fog catchers. Phase 2: Determine elements to design the model for Mexico. On the other hand, were consulted on hard data and figures of the agribusiness at the national level (Mexico), to know the relevance of this type of project in the fight against drought and scarcity of vital liquid. More efficient methods were also identified, such as fog capture at a more affordable cost, using the environmental variable of relative humidity in the region.

5. Results and Discussion

The model was designed based on such mathematical conditions and variables. According to Zayas(2019)in his analytical mechanics model for a raindrop falling through a wet medium collecting mass as it falls as shown in Figure 1.

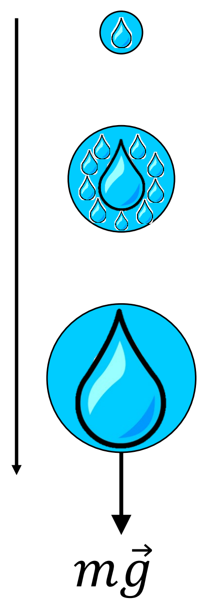

Figure 1. Representation of the collected mass of a raindrop in free fall.
Source: Elaborated based on Zayas (2019).

Table 2. Mathematical Model

Linear momentum, or simply *momentum,* is defined as the product of mass times velocity, that is:	$p = mv$
And force, in the definition of Newton's second law, is the derivative of momentum with respect to time:	$F = \frac{dp}{dt} = \frac{d(mv)}{dt} = m\frac{dv}{dt} + v\frac{dm}{dt}$
In this problem, the mass is not constant since the drop is collecting mass as it falls. The problem statement also states that the growth of the mass in the droplet as it falls is proportional to the area of the sphere $A = 4\pi r^2$ and we know that the latter is a	*Then:* $dm(t)/dt \propto A(r(t))$ *Or:* $dm(t)/dt = kA(r(t))$ *(1)*

function of the radius of the drop, which, in turn, is a function of time.	
Where k is a constant of proportionality. In addition, the mass $m(t)$ of the droplet, being a sphere of uniform density ρ (in fact, the density of water), is given by:	*m(t)= ρV(t)=4/3 πρ[r(t)]^3* *(2)*
So, the condition established by equation (1), becomes:	$$\frac{d\left[\frac{4}{3}\pi\rho[r(t)]^3\right]}{dt} = k4\pi[r(t)]^2$$ *(3)*
Deriving:	$$\frac{4}{3}\pi\rho 3[r(t)]^2\frac{dr(t)}{dt} = k4\pi[r(t)]^2$$
Simplifying, we obtain:	$$\frac{dr(t)}{dt} = \frac{k}{\rho}$$
If we integrate with respect to time, we obtain the expression of the radius of the droplet as a function of time r of the drop as a function of time:	$$\int_0^t \frac{dr(t)}{dt}dt = \int_0^t \frac{k}{\rho}dt$$
From where:	$$r(t) = r_0 + \frac{k}{\rho}t$$ (4)
Substituting equation (4) into equation (3), we obtain the expression of mass as a function of time:	$$m(t) = \frac{3}{4}\pi\rho\left[r_0 + \frac{k}{\rho}t\right]^3$$ (5)
Note that, in particular:	$$m_0 = m(0) = \frac{4}{3}\pi\rho r_0^3$$ And, in addition: $$\frac{dm(t)}{dt} = 4\pi k\left[r_0 + \frac{k}{\rho}t\right]^2$$
On the other hand, if we omit the friction with the wind, the only external force acting on the drop is gravity, so the equation of motion for the drop is:	$$-m(t)g = \frac{d(m(t)v(t))}{dt}$$ This is; $$-m(t)g = m(t)\frac{dv(t)}{dt} + v(t)\frac{dm(t)}{dt}$$
Dividing the equation by $m(t)$we have:	$$-g = \frac{dv(t)}{dt} + v(t)\frac{1}{m(t)}\frac{dm(t)}{dt}$$
Substituting in this differential equation $m(t)$ and its derivative $\frac{dm(t)}{dt}$we obtain;	$$-g = \frac{dv(t)}{dt} + v(t)\frac{4\pi k\left[r_0 + \frac{k}{\rho}t\right]^2}{\frac{4}{3}\pi\rho\left[r_0 + \frac{k}{\rho}t\right]^3}$$
From where:	$$\frac{dv(t)}{dt} + v(t)\frac{3k}{[\rho r_0 + kt]} = -g$$
This last expression is a differential equation of the form:	$$a_1(t)\frac{dv}{dt} + a_0(t)v = g(t)$$ $$\Rightarrow \frac{dv}{dt} + \frac{a_0(t)}{a_1(t)}v = \frac{g(t)}{a_1(t)}$$ $$\Rightarrow \frac{dv}{dt} + P(t)v = f(t)$$

This type of equation is solved by applying an integrating factor as follows. First, we rewrite the differential equation in the form:	$dv + [P(t)v - f(t)]dt = 0$
Now it is possible to multiply the whole equation by a factor that we will call $\mu(t)$	$\Rightarrow \mu(t)dv + \mu(t)[P(t)v - f(t)]dt = 0$
Now, the theory of differential equations holds that, if we have an equation of the form:	$M(x,y)dx + N(x,y)dy = 0$
This will have an exact solution if: $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ In our case we have that: $\frac{\partial \mu(t)}{\partial t} = \frac{\partial}{\partial v}\mu(t)[P(t)v - f(t)]dt$	$\Rightarrow \frac{d\mu(t)}{dt} = \mu(t)P(t) \quad \Rightarrow \frac{d\mu(t)}{\mu(t)} P(t)dt$
Integrating both sides we will have that: What is the so-called integrating factor	$ln\|\mu(t)\| = \int P(t)dt \Rightarrow \mu(t) = e^{\int P(t)dt}$
In our equation, clearly $P(t) = \frac{3k}{[\rho r_0 + kt]}$ so, the integrating factor is:	$\mu(t) = e^{\int \frac{3k}{[\rho r_0 + kt]}}$
We solve the integral by a change of variable, $u = \rho r_0 + kt$:	$\int_0^t \frac{3kdt}{[\rho r_0 + kt]} = 3\int_{u(0)}^{u(t)} \frac{du}{u} = 3\,ln\left(\frac{\rho r_0 + kt}{\rho r_0}\right)$
And, hence, the integrating factor is:	$\mu(t) = e^{3\,ln\left(1+\frac{kt}{\rho r_0}\right)} = \left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3$
Multiplying our differential equation by the integrating factor, we obtain:	$\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3 + \frac{dv(t)}{t} + \left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3 \left[v(t)\frac{3k}{(\rho r_0 + kt)}\right] = -g\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3$ From where: $\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3 + \frac{dv(t)}{t} + \left[v(t)\frac{3k}{\rho r_0}\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^2\right] = -g\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3$
The first term is clearly the derivative of the product of $\mu(t)v(t)$, so the equation can be rewritten as:	$\frac{d\left[v(t)\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3\right]}{dt} = -g\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3$
Now we only need to integrate the above equation with respect to time:	$\int_0^t \frac{d\left[v(t)\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3\right]}{dt} = -g\int_0^t \left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3 dt$ From where: $v(t)\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3 - v_0 = -g\frac{\rho r_0}{4k}\left[\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^4 - 1\right]$

From where finally, we obtain the velocity as a function of time:	$v(t) = \frac{v_0}{\left(\frac{\rho r_0+kt}{\rho r_0}\right)^3} - g\frac{\rho r_0}{4k}\left[\left(\frac{\rho r_0 + kt}{\rho r_0}\right)^4 - \frac{1}{\left(\frac{\rho r_0+kt}{\rho r_0}\right)^3}\right]$ *Or:* $v(t) = \frac{\rho^3 r_0^3 v_0 - \frac{g}{4k}[(\rho r_0 + kt)^4 - \rho^4 r_0^4]}{(\rho r_0 + kt)^3}$ *Another equivalent expression of the above equation is:* $v(t) = \frac{\rho^3 r_0^3(4kv_0 - g\rho r_0)}{4k(\rho r_0 + kt)^3} - \frac{g(\rho r_0 + kt)}{4k}$
If we remember that $m(t) = \frac{4}{3}\pi\rho\left[r_0 + \frac{k}{\rho}t\right]^3$ y $m_0 = m(0) = \frac{4}{3}\pi\rho r_0^3$, we have that:	$\frac{m(t)}{m_0} = \left(\frac{\rho r_0 + kt}{\rho r_0}\right)^3$
If we substitute this result in the first equation $v(t)$, we will have that:	$v(t) = \frac{m_0 v_0}{m(t)} - \frac{g\rho r_0 m_0}{4km(t)}\left[\frac{m(t)}{m_0}\left(\frac{\rho r_0 + kt}{\rho r_0}\right) - 1\right]$ *Or:* $v(t) = \frac{m_0 v_0}{m(t)} - \frac{g}{4k}\left[\rho r_0 + kt\left(\frac{\rho r_0 m_0}{m(t)}\right)\right]$
Another useful expression of the above equation is the one obtained by substituting the value of $m(t)$:	$v(t) = \frac{3m_0 v_0}{4\pi\rho\left[r_0 + \frac{k}{\rho}t\right]^3} - \frac{g}{4k}\left[\rho r_0 + kt - \frac{3r_0 m_0}{4\pi\left[r_0 + \frac{k}{\rho}t\right]^3}\right]$ *From where:* $v(t) = \frac{3m_0}{16k\pi\rho} - \left[\frac{4kv_0 + g\rho r_0}{\left(r_0 + \frac{k}{\rho}t\right)^3}\right] - \frac{g}{4k}(\rho r_0 + kt)$
If the density of the liquid of which the drop is made is not known (assuming it is not water), the value of ρ in the above equation, taken from the expression $\rho = \frac{3m_0}{4\pi r_0^3}$	$v(t) = \frac{3m_0}{(16k\pi)\left(\frac{3m_0}{4\pi r_0^3}\right)}\left[\frac{4kv_0 + g\frac{3m_0}{4\pi r_0^3}r_0}{\left(r_0 + \frac{k}{\frac{3m_0}{4\pi r_0^3}}t\right)^3}\right] - \frac{g}{4k}\left(\frac{3m_0}{4\pi r_0^3}r_0 + kt\right)$ *From where:* $v(t) = \frac{27m_0^3 r_0}{16k\pi}\left[\frac{16k\pi r_0^2 v_0 + 3gm_0}{(3m_0 r_0 + 4k\pi r_0^3 t)^3}\right] - \frac{g}{16k\pi r_0^3}(3m_0 r_0 + 4k\pi r_0^3 t)$
And the acceleration of the drop is calculated by deriving the above expression with respect to time:	$a(t) = \frac{dv(t)}{dt} = \frac{-27m_0^3 r_0^4}{4}\left[\frac{16k\pi r_0^2 v_0 + 3gm_0}{(3m_0 r_0 + 4k\pi r_0^3 t)^4}\right] - \frac{g}{4}$
Note that if $m_0 = 0$, then, the above equations reduce to:	$v(t) = -\frac{gt}{4};\ a(t) = -\frac{g}{4}$

Source: Zayas, (2019).

The purpose of this equation is to analyze the location and volume of water to be collected, i.e., we seek to bombard the clouds with silver nitrate, however, it is important to define the most precise location for the installation of the device that will be responsible for collecting the vital liquid.

For this reason, a wide search of cases of use of silver nitrate, cloud bombardment experiments, fog sublimation, and water harvesting, in different parts of the world was conducted to analyze under what conditions of pressure, temperature, humidity, and dew point positive results were obtained, in order to replicate the best practices in Mexico City.

Therefore, the Model to determine the level of humidity Cloud Seeding for Agribusiness expresses the following results:it is estimated that an average of 10% of the water will be captured by cloud bombardment, and 10% by fog capture. Analyze which technique generates greater benefits for agribusiness Ho hypothesis test.

6. Conclusion

According to the documentary research, we propose the design of a device that efficiently allows the collection of water, that is, without using Silver Iodide (add a conclusive figure, the good thing about this model is and add comparative analysis advantages and disadvantages), significantly decreasing the operating costs and increasing the amount of water collected through the conditions of pressure, temperature and relative humidity in agribusinesses located in Mexico City.

In this way, we actively contribute to the fulfillment of three of the Sustainable Development Goals, which are: SDG 2. Zero Hunger, due to obtaining the expected harvests to meet current and future demand without interruptions in the supply chain, SDG 6. Clean Water and Sanitation, facilitating access to atmospheric water in indigenous peoples and marginalized areas, not only for domestic use but with a business approach since up to 70% of the water used in the world is used for irrigation. SDG 9. Responsible Production and Consumption, population growth exerts a strong pressure and demand for available resources, which is why we must optimize available resources to maintain the current lifestyle.

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