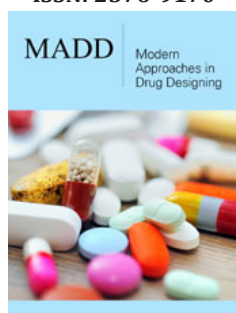


Combating COVID-19: Exploiting the Viral Physical Properties

Rania M Hathout*

Department of Pharmaceutics and Industrial Pharmacy, Faculty of Pharmacy, Ain Shams University, Cairo, Egypt

ISSN: 2576-9170



Abstract

The war against COVID-19 pandemic is continuing. All the scientific disciplines are uniting in order to protect the whole humanity against the causing virus; the corona virus (SARS-CoV-2). The physical approaches such as the electrostatic can provide us with a new weapon in this tough war through exploiting the repulsive properties of positively charged biocompatible polymers.

Keywords: COVID-19; Pandemic; Corona; Virus; Physical; Polymers; Positive

Introduction

Since the beginning of the year 2020, the world is having a serious battle against the COVID-19 pandemic. Many pharmacological and chemical approaches have been considered since then in order to combat the disease Lu [1] including the use of drugs such as hydroxychloroquine, azithromycin, lactoferrin, zinc salts, favipiravir, remdesivir, interferon-alpha 2B and dexamethasone has been considered and evaluated Barnard et al. [2], Haeger et al. [3]; Wang et al. [4]; Colson et al. [5]; Gautret et al. [6]; Yang et al. [7] and Hathout et al. [8]. The main mechanisms of action of these drugs lie on the chemical interaction between these molecules and certain biological receptors whether on the human respiratory tract or on the virus on one hand or rather reducing the immune responses to prevent the lethal cytokines storm caused at the latter stages of the disease Jia et al. [9]; Inoue et al. [10]; Lang et al. [11]; Milewska et al. [12]; Kaushik et al. [13] and Quiros Roldan et al. [14]. Several vaccines are also currently being experimented and some of them have reached phase III trials. These approaches are warranted and may lead to permanent combating of the disease (and may not). However, there is paucity in dealing with the virus as regards to its physical and physico-chemical properties though these characteristics might give us a clue or a key for prophylaxis or at the best, decreasing the viral load that susceptible subjects may face.

The corona virus is a particle that holds a particle diameter of an average of 80nm Kim et al. [15]. This renders this particle as a nanoparticulate system and actually a colloidal particle that should possess a zeta potential and undergoes Brownian movement while suspended in its beholding droplets Fagir et al. [16]. In this context, it was actually proven that the corona viral capsid and some of its motifs carry a positive zeta potential Belyi et al. [17]; Hu et al. [18] and Forrey et al. [19]. Exploiting this finding could lead us to important pathways in combating the virus. For example, biocompatible (regarded as a very important criteria Hathout et al. [20] positively charged polymers such as the chitosan (Farid et al. [21] and Abdelhamid et al. [22] (and its derivatives such as the quaternized chitosan), gelatin A Shokry et al. [23]; Hathout et al. [24]; Ossama et al. [25] and polypyrrole Shah et al. [26] can be used to prepare nano-systems ; nanoparticles or nanofibers. These nano-systems can be incorporated or embedded in the fabrics of clothes and the prevention tools of the health care providers. The presence of these incorporated nano-sized positively charged systems would help in repelling the virus (like charges) and hence prevent it from depositing on the clothes and tools surfaces Hathout RM et al. [27].

***Corresponding author:** Rania M Hathout, Department of Pharmaceutics and Industrial Pharmacy, Faculty of Pharmacy, Ain Shams University, African Union Organization St., 11566 Cairo, Egypt, Tel: +2 (0) 100 5254919, E-mail: r_hathout@yahoo.com

Submission:  September 29, 2020

Published:  October 16, 2020

Volume 3 - Issue 2

How to cite this article: Rania M Hathout. Combating COVID-19: Exploiting the Viral Physical Properties. Mod Appro Drug Des. 3(2). MADD. 000557. 2020. DOI: [10.31031/MADD.2020.03.000557](https://doi.org/10.31031/MADD.2020.03.000557)

Copyright@ Rania M Hathout. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

In another encounter, these nano-sized systems (specifically, the naturally-driven ones; chitosan and gelatin) could be incorporated in different pharmaceutical and cosmeceutical preparations that are administered topically such as: the gels, the toothpastes the mouth gargles and the nasal drops in order to block the viral entry to the respiratory tract through the mouth and the nose orifices.

Conclusion

To sum up, the physical (electrical) approaches can provide us with a novel solution rendering the virus less infective and less damaging.

References

- Lu H (2020) Drug treatment options for the 2019-new coronavirus (2019-nCoV). *Biosci Trends* 14: 69-71.
- Barnard DL, Day CW, Bailey K, Heiner M, Montgomery R, et al. (2006) Evaluation of immunomodulators, interferons and known *in vitro* SARS-coV inhibitors for inhibition of SARS-coV replication in BALB/c mice. *Antivir Chem Chemother* 17(5): 275-284.
- Haeger SM, Yang Y, Schmidt EP (2016) Heparan sulfate in the developing, healthy, and injured lung. *Am J Respir Cell Mol Biol* 55(1): 5-11.
- Wang M, Cao R, Zhang L, Yang X, Liu J, et al. (2020) Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) *in vitro*. *Cell Res* 30(3): 269-271.
- Colson P, Rolain JM, Raoult D (2020) Chloroquine for the 2019 novel coronavirus SARS-CoV-2. *Int J Antimicrob Agents* 55(3): 105923.
- Gautret P, Lagier JC, Parola P, Hoang VT, Meddeb L, et al. (2020) Hydroxychloroquine and azithromycin as a treatment of COVID-19: Results of an open-label non-randomized clinical trial. *Int J Antimicrob Agents* 56(1): 105949.
- Yang A, Yang C, Yang B (2020) Use of hydroxychloroquine and interferon alpha-2b for the prophylaxis of COVID-19. *Medical Hypotheses* 144: 109802.
- Hathout RM, Abdelhamid SG, Metwally AA (2020) Chloroquine and hydroxychloroquine for combating COVID-19: Investigating efficacy and hypothesizing new formulations using Bio/chemoinformatics tools. *Inform. Med Unlocked* 21: 100446.
- Jia HP, Look DC, Shi L, Hickey M, Pewe L, et al. (2005) ACE2 receptor expression and severe acute respiratory syndrome coronavirus infection depends on differentiation of human airway epithelia. *J Virol* 79(23): 14614-14621.
- Inoue Y, Tanaka N, Tanaka Y, Inoue S, Morita K, et al. (2007) Clathrin-dependent entry of severe acute respiratory syndrome coronavirus into target cells expressing ACE2 with the cytoplasmic tail deleted. *J Virol* 81(16): 8722-8729.
- Lang J, Yang N, Deng J, Liu K, Yang P, et al. (2011) Inhibition of SARS pseudovirus cell entry by lactoferrin binding to heparan sulfate proteoglycans. *PLoS One* 6(8): e23710.
- Milewska A, Zarebski M, Nowak P, Stozek K, Potempa J, et al. (2014) Human coronavirus NL63 utilizes heparan sulfate proteoglycans for attachment to target cells. *J Virol* 88(22): 13221-13230.
- Kaushik N, Subramani C, Anang S, Muthumohan R, Nayak B, et al. (2017) Zinc salts block hepatitis E virus replication by inhibiting the activity of viral RNA-dependent RNA polymerase. *J Virol* 91(21): e00754-17.
- Quiros Roldan E, Biasiotto G, Magro P, Zanella I (2020) The possible mechanisms of action of 4-aminoquinolines (chloroquine/hydroxychloroquine) against Sars-Cov-2 infection (COVID-19): A role for iron homeostasis? *Pharmacological Research* 158: 104904.
- Kim JM, Chung YS, Jo HJ, Lee NJ, Kim MS, et al. (2020) Identification of coronavirus isolated from a patient in Korea with COVID-19. *Osong Public Health Res Perspect* 11(1): 3-7.
- Fagir W, Hathout RM, Sammour OA, ElShafeey AH (2015) Self-microemulsifying systems of Finasteride with enhanced oral bioavailability: Multivariate statistical evaluation, characterization, spray-drying and *in vivo* studies in human volunteers. *Nanomedicine (Lond)* 10(22): 3373-3389.
- Belyi VA, Muthukumar M (2006) Electrostatic origin of the genome packing in viruses. *Proc Natl Acad Sci USA* 103(46): 17174.
- Forrey C, Muthukumar M (2009) Electrostatics of capsid-induced viral RNA organization. *J Chem Phys* 131(10): 105101.
- Hu T, Zhang R, Shklovskii BI (2008) Electrostatic theory of viral self-assembly. *Physica A: Statistical Mechanics and its Applications* 387(12): 3059-3064.
- Hathout RM, Manosur S, Mortada ND, Guinedi AS (2007) Liposomes as an ocular delivery system for acetazolamide: *In vitro* and *in vivo* Studies. *AAPS Pharm SciTech* 8(1): E1-E12.
- Farid MM, Hathout RM, Fawzy M, Abou-Aisha K (2014) Silencing of the scavenger receptor (Class B - Type 1) gene using siRNA-loaded chitosan nanoparticles in a HepG2 cell model. *Colloids Surf B Biointerfaces* 123: 930-937.
- Abdelhamid HN, El-Bery HM, Metwally AA, Elshazly M, Hathout RM (2019) Synthesis of CdS-modified chitosan quantum dots for the drug delivery of Sesamol. *Carbohydr Polym* 214: 90-99.
- Shokry M, Hathout RM, Mansour S (2018) Exploring gelatin nanoparticles as novel nanocarriers for timolol maleate: Augmented *in-vivo* efficacy and safe histological profile. *Int J Pharm* 545(1-2): 229-239.
- Hathout RM, Metwally AA (2019) Gelatin Nanoparticles. *Methods Mol Biol* 2000: 71-78.
- Ossama M, Hathout RM, Attia DA, Mortada ND (2019) Enhanced allicin cytotoxicity on HEPG-2 cells using glycyrrhetic acid surface-decorated gelatin nanoparticles. *ACS Omega* 4(6): 11293-11300.
- Shah SAA, Firlak M, Berrow SR, Halcovitch NR, Baldock SJ, et al. (2018) Electrochemically enhanced drug delivery using polypyrrole films. *Materials (Basel)* 11(7): 1123.
- Hathout RM, Kassem DH (2020) Positively charged electroceutical spun chitosan nanofibers can protect health care providers from COVID-19 infection: An opinion. *Frontiers in Bioengineering and Biotechnology* 8: 885.

For possible submissions Click below:

Submit Article